Supreme Court, U. S.
FILED
MAY 18 1978
MICHAEL RODAK, JR., CLERK

IN THE

Supreme Court of the United States

OCTOBER TERM, 1977

No. 77-1640

CLARK EQUIPMENT COMPANY,
Petitioner

versus

LOUIS J. KELLER AND CYRIL N. KELLER,
Respondents

APPENDIX FOR
PETITION FOR A WRIT OF CERTIORARI TO THE
UNITED STATES COURT OF APPEALS FOR THE
EIGHTH CIRCUIT

JACK E. TOLIVER
Circle Drive
Buchanan, Michigan 49107

FRED E. SCHULZ and
Wildman, Harrold, Allen & Dixon
One IBM Plaza
Chicago, Illinois 60611

JOHN D. KELLY,
Vogel, Brantner, Kelly,
Knutson, Weir & Bye
P.O. Box 1329
Fargo, North Dakota 58102

Attorneys for Petitioner

APPENDIX INDEX

Title of Exhibit	Pages	Exhibit Number*
1. Keller et al Patent No. 3,151,503	1-4	53
2. Loyd Patent No. 1,623,929	5-10	84
3. Schreck Patent No. 2,336,642	11-18	85
4. Hellwarth Patent No. 1,470,078	19-25	86
5. White Patent No. 2,936,840	26-35	75
6. Butler Sketch	36	100

*Trial exhibit numbers are used in the District Court's opinion appearing in Appendix B.

Oct. 6, 1964 L. J. KELLER ETAL 3,151,503

TRANSMISSION SYSTEM

Filed Dec. 1, 1958

FIG. 1

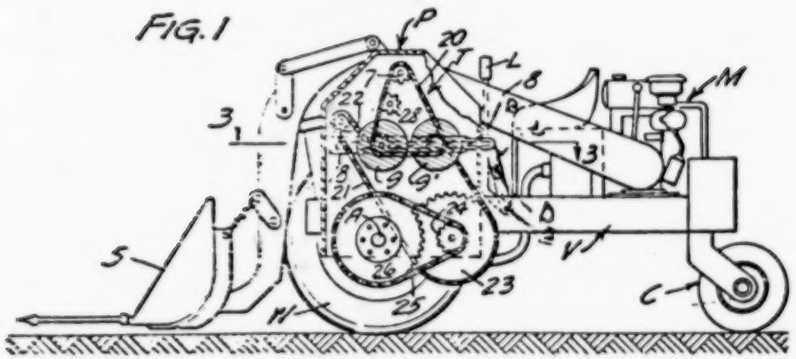


FIG. 2

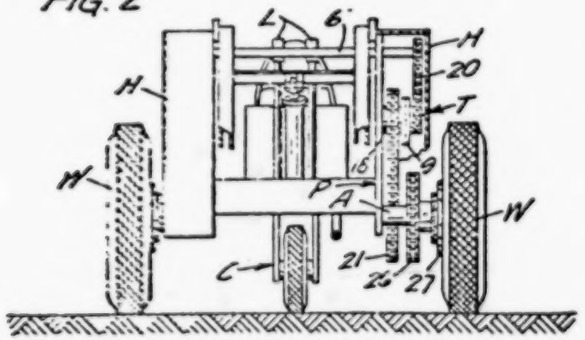


FIG. 3

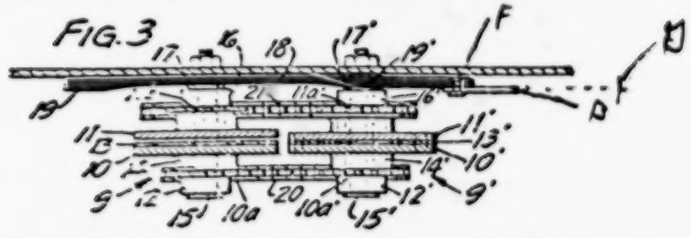


FIG. 4

INVENTOR
LOUIS J. KELLER
CYRIL N. KELLER
BY Williamson, Schroeder & Halmatin
ATTORNEYS

Ex 53
CLARK

3,151,503
TRANSMISSION SYSTEM
Louis J. Keller and Cyril N. Keller, Roseau, Minn.
Filed Dec. 1, 1958, Ser. No. 777,268
4 Claims. (Cl. 74—722)

This invention relates to systems for transmitting driving power from a power unit to propulsion wheels, drive shafts and the like, and in particular to a transmission system for self-propelled vehicles having independently rotatable propulsion or drive wheels.

An object of our invention is a transmission system for self-propelled wheeled vehicles such as tractors, loaders, sweepers and the like, which imparts maximum maneuverability to such vehicles.

OBJECTS

Another object is a transmission system for each wheel which permits the wheel to be independently driven forwards or backwards or idled as desired.

Still another object is a selective (forward, reverse, neutral drive) transmission system for each independent propulsion wheel for differential driving of the wheels which enable a pair of wheels so equipped to serve not only as the driving mechanism but also as the steering mechanism, the transmission system being particularly adaptable to vehicles having two independent propulsion wheels and a caster or swivel wheel for maneuverability.

A further object is a selective transmission system for an independent propulsion wheel in which the direction or nature of the driving force is altered by a shifting bar whose movements are controlled by a single simple control lever in the cab of the vehicle.

A still further object is a transmission system for an independent propulsion wheel which combines a clutch adapted for forward drive with a clutch adapted for reverse driving in the same system and means for engaging either of said clutches for drive operation or permitting both clutches to disengage causing idling of said wheel.

These and other objects and advantages of our invention will more fully appear from the following description made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a side elevational view of a loader vehicle for employing the transmission system of our invention with portions thereof broken away for clarity of detail as an aid to understanding;

FIG. 2 is a front elevational view with a scoop portion of a loader removed and one side of the tractor broken away for clarity;

FIG. 3 is a top plan view of the clutch mechanism taken on the line 3—3 of FIG. 1 in partial section; and

FIG. 4 is a detail view of the cammed operating lever.

Referring to the drawings which disclose a preferred form of our invention, a front end loader vehicle indicated generally by the letter V has a pair of laterally spaced independently rotatable propulsion wheels W mounted on dead axles or stubshafts A positioned forward of the vehicle, a motor M mounted thereon for driving said wheels, a caster or swivel wheel C positioned rearwardly of the loader to impart maneuverability and stability to the loader, a scoop S and a pair of spaced vertical supporting plates P. Extending between and through each of the plates P and supported thereby near the top thereof is a horizontally disposed jack or drive shaft 6 having sprocket wheels 7 affixed to the ends thereof outwardly of the plates P, the shaft 6 and wheel 7 being continuously driven or rotated by means of an endless chain enclosed in housing 8 which is connected with and driven by motor M.

The loader is provided with a pair of identical but separate transmission systems for transmitting the driving power from jack shaft 6 to each of the propulsion wheels

W, each of said transmission systems being mounted on and supported by a plate P and indicated generally by the letter T, each of said transmission systems being enclosed by a housing H. The separate but identical transmission systems T mounted on each of the plates P are adapted to selectively transmit forward or reverse driving power from the jack shaft 6 to one of the propulsion wheels W, and is also adapted to permit idling of the wheel when desired.

In the form of our invention shown in the drawings, each transmission system T includes a pair of clutch units indicated generally by 9 and 9', one unit being for forward drive, the other for reverse drive. These clutch units each consist of a pair of clutch plates 10 and 11 and 10' and 11' respectively which are rotatably and coaxially mounted on horizontally spaced stubshafts 12 and 12' respectively, which shafts project laterally outwardly from and are supported by plate P, the opposing clutch plates being adapted for movement into radial frictional clutching engagement with one another.

Each of the clutch plates has projecting therefrom and coaxially united therewith a sprocket wheel for rotating the clutch plate, these sprocket wheels being indicated by the numerals 10*a*, 11*a*, 10*a*' and 11*a*' respectively. One clutch plate of each clutch unit has superimposed on and secured to its clutching surface a friction disc as indicated by 13 and 13' respectively. The outwardly disposed sprocket wheels 10*a* and 10*a*' abut with bearings 14 and 14' and are held on shafts 12 and 12' by means of end caps 15 and 15' respectively. Inwardly disposed of sprockets 11*a* and 11*a*' are bearings 16 and 16' and pressure collars or cam followers 17 and 17' which are mounted coaxially with sprockets 11*a* and 11*a*' on stubshafts 12 and 12', and are axially movable thereon. Said pressure collars 17 and 17', bearings 16 and 16', sprockets 11*a* and 11*a*' and clutch plates 11 and 11' are slidable back and forth along shafts 12 and 12' to enable plates 11 and 11' to move into and out of clutching engagement with friction discs 13 and 13' respectively, causing plates 11 and 11' to be rotatably driven by opposing revolving plates 10 and 10' respectively.

Mounted on plate P and interposed between plate P and cam followers 17 and 17' is an elongate shifting bar 18 whose outer face tapers inwardly from the ends thereof so that the thickest or drive portions 19 and 19' of the bar are found adjacent the ends thereof, and form camming surfaces which selectively engage the inner surfaces of cam followers 17 and 17' to move their respective clutches into driving engagement. The thinner central portion 19*a* of the shifting bar represents the neutral portion, and is of a length to permit it to oppose both cam followers simultaneously to disengage both clutches simultaneously and permit idling of the wheel W. Longitudinal slot 19*b* of bar 18 encloses stubshafts 12 and 12', and bar 18 is adapted to slide horizontally back and forth normal to the stubshafts 12 and 12' to selectively engage cam followers 17 and 17' and slide them in and out as they engage different parts of the cam surface, causing them to bear against their respective bearings which in turn bear against their respective sprockets and clutch plates 11 and 11' causing them to slide or move into clutching driving engagement with their respective plates 10 or 10'. Each of the bars 18 are caused to move backwards and forwards by means of one of the operating levers L in the cab of the vehicle, which are connected by suitable linkage to the bars.

Endless chain belt 20 is trained around sprocket 10*a*, 10*a*', chain belt tightner sprocket 25 and sprocket 7 of jack shaft 6 as shown in FIG. 1, causing clutch plates 10 and 10' to be rotated or driven continuously in the same direction (counterclockwise as shown in the draw-

BEST COPY AVAILABLE

ings) by the continuously rotating jack shaft 6 and sprocket 7.

As shown in the drawings, endless chain 21 is trained over sprocket 11a' and under sprocket 11a and thence around a rotatable idler or belt tightener sprocket wheel 22 and rotatably mounted gear reduction sprocket wheel 23 which is connected with and serves to rotate smaller reduction sprocket 24. Another endless chain 25 is trained around sprocket 24 and a sprocketed wheel 26 which is integrally united with, and serves to drive a wheel mounting disc 27 upon which is mounted wheel W.

By training the endless chain 21 under one sprocket wheel and over the other, the chain 21, and with it wheel W, will be driven in opposite directions according to which clutching unit is engaged, thereby providing selective reverse and forward driving of the propulsion wheel W.

In the operation of the form of our invention as shown in the drawings, in which only the transmission system for the left side of the vehicle is shown and described, the jack shaft 6 and clutch plates 10 and 10' are driven continuously in a counterclockwise direction. To drive the left side propulsion wheel W forward, the shifting bar 18 is moved forward by proper manipulation of one of the operating levers L in the cab until the various portions of the clutch assembly assume the positions shown in FIG. 3.

In the arrangement shown in FIG. 3, the drive camming surface 19' of bar 18 engages cam follower 17' and presses it outwardly, forcing the clutch plates 13' and 11' into clutching driving engagement, while cam follower 17 is opposed by the neutral surface 19a, which causes clutch unit 9 to be disengaged. Because the endless chain 21 is trained over sprocket 11a', which is driven counterclockwise in FIG. 3, the chain 21 is also caused to move in a counterclockwise direction which in turn, through the gear reduction and chain drive mechanism shown, drives propulsion wheel W in a counterclockwise or forward direction, thus in effect making clutch unit 9' the forward drive unit.

To drive the propulsion wheel rearwardly or in reverse direction, the shifting bar is moved backwards or to the rear, causing drive cam surface 19 to engage cam follower 17 and press clutch plates 10 and 11 into clutching engagement, with cam follower 17' moving into opposition with the neutral surface 19a, causing disengagement of clutch unit 9'. In this situation, with the sprocket wheel 11a being driven counterclockwise and the chain 21 being trained thereunder, the chain 21 is driven in a clockwise direction and in turn causes propulsion wheel W to rotate in a clockwise or reverse direction, thus in effect making clutch unit 9 the reverse drive unit.

To permit idling of the propulsion wheel W, the shifting bar 18 is moved to an intermediate or neutral position in which both cam followers 17 and 17' are placed in opposition to the thinner neutral surface 19a, causing disengagement of both clutching units 9 and 9'.

It is, of course, to be understood that the foregoing description applies equally well to the operation of both transmission systems and propulsion wheels on either side of the vehicle.

From the foregoing, the advantages of our invention are readily apparent. By manipulating the pair of operating levers in the cab, the propulsion wheels W may be simultaneously driven forwards or backwards to cause forward or reverse movement of the vehicle, or one wheel may be idled while the other is driven forwards or backwards, thus permitting the vehicle to pivot on the idle wheel and be turned in any desired direction, thus giving the vehicle maximum maneuverability and permitting the transmission system in cooperation with the propulsion wheels to perform the dual functions of driving and steering the vehicle.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of our invention.

What is claimed is:

1. In a self-propelled vehicle having independently rotatable propulsion wheels and a source of power for driving said wheels, a separate transmission system for propelling each of said wheels, each said transmission system comprising a pair of clutches, each said clutch comprising a pair of rotatable, coaxially mounted clutch plates adapted for movement into and out of frictional clutching engagement with one another, belt drive means interconnecting one clutch plate of each clutch with each other and with the source of power and adapted to rotate said clutch plates simultaneously in the same direction, belt drive means interconnecting the other clutch plate of each clutch with each other and with the propulsion wheel, the connection between the belt drive and the clutch plates being such that each plate drives the belt and propulsion wheel in an opposite direction to provide forward and reverse drive for said wheel, cam follower means associated with each of said clutches, and a movable shifting member having a camming surface opposed to and contiguous with adjacent pairs of said cam follower means, said camming surface including a pair of drive promoting cam portions and an idling portion and means for moving said member to selectively engage one of said drive promoting cam portions with one of said cam followers or with said idling portion to transmit forward or reverse driving power to said propulsion wheel or simultaneously disengage both clutches to permit idling of said wheel.

2. A self-propelled vehicle having a pair of spaced apart independently rotatable propulsion wheels, a caster wheel for maneuverability thereof, an operating cab and a source of power for driving said wheels, a common drive shaft driven by said power source and supplying driving power to each of said propulsion wheels, a separate transmission system for transmitting propelling power from said common drive shaft to each of said wheels, each said transmission system comprising a pair of juxtaposed substantially aligned axially parallel clutches, each said clutch comprising a pair of rotatable, co-axially mounted clutch plates adapted for relative axial movement into and out of frictional clutching engagement with one another, belt drive means interconnecting one clutch plate of each clutch with each other and with said common drive shaft to rotate said clutch plates simultaneously in the same direction, belt drive means interconnecting the other clutch plate of each clutch with each other and with a propulsion wheel, each of said other clutch plates being engaged with opposite sides of said belt drive means for reverse driving of said belt drive means and said propulsion wheel, follower means carried by each clutch directing the relative axial movement of the clutch plates constituting said clutch, an elongate slidable shifting member having a camming surface disposed transversely of the axis of rotation of said clutches and contiguously opposed to each of said cam follower means, said camming surface including a pair of longitudinally spaced apart protruding follower engaging drive promoting cam portions and an elongate recessed idling portion intermediate said cam portion for disengaging either of said clutches or both simultaneously, and means including a single operating member in the cab for reciprocating said slidable member across said cam followers to selectively engage one of said cam portions with one of said cam follower means to drivingly engage one of said clutches while simultaneously idling the other to optionally drive the propulsion wheel forwardly or backwardly or to simultaneously disengage both clutches to idle said wheel.

3. In a self-propelled vehicle having independently rotatable propulsion wheels and a source of power for driving said wheels, a separate transmission system for propelling each of said wheels, each said transmission system comprising a pair of clutches, each of said clutches comprising a pair of rotatable, co-axially mounted clutch plates adapted for movement into and out of frictional clutching engagement with one another, first belt drive means interconnecting one clutch plate of each clutch with each other and with the source of power and adapted to rotate said clutch plates simultaneously, second belt drive means interconnecting the other clutch plate of each clutch with each other and with the propulsion wheel, one of said belt drive means being wound in the same direction with respect to the plates engaged therewith whereby movement thereof in one direction causes rotation of said plates in the same direction, the other of said belt drive means being wound in opposite directions with respect to the plates engaged therewith whereby movement thereof in one direction causes rotation of said plates in opposite directions, cam follower means associated with each of said clutches, and a movable shifting member having a camming surface opposed to and contiguous with adjacent pairs of said cam follower means, said camming surface including a pair of drive promoting cam portions and an idling portion and means for moving said member to selectively engage one of said drive promoting cam portions with one of said cam followers or with said idling portion to transmit forward or reverse driving power to said propulsion wheel or simultaneously disengage both clutch to permit idling of said wheel.

4. In a self-propelled vehicle having independently rotatable propulsion wheels and a source of power for driving said wheels, a separate transmission system for propelling each of said wheels, each said transmission system comprising a pair of clutches, each of said clutches comprising a pair of rotatable, co-axially mounted clutch plates adapted for movement into and out of frictional clutching engagement with one another, first belt drive means interconnecting one clutch plate of each clutch with each other and with the source of power and adapted to rotate said clutch plates simultaneously, second belt drive means interconnecting the other clutch plate of each clutch with each other and with the propulsion wheel, one of said belt drive means being wound in the same direction with respect to the plates engaged therewith whereby movement thereof in one direction causes rotation of said plates in the same direction, the other of said belt drive means being wound in opposite directions with respect to the plates engaged therewith whereby movement thereof in one direction causes rotation of said plates in opposite directions with respect to each other, cam follower means cooperatively interconnected with each of said clutches, and shifting means including single cam members interconnected by a single shiftable connecting member and contiguous with each of said cam follower means and adapted to selectively cammingly engage one or the other of said cam follower means upon shifting movement of said connecting member for selectively engaging one or the other of said clutches or to simultaneously disengage both of them to permit idling of said wheel.

References Cited in the file of this patent

UNITED STATES PATENTS

821,477	Flinchbaugh	May 22, 1906
1,027,027	Bailey	May 21, 1912
1,470,078	Hellwarth	Oct. 9, 1923
1,623,929	Loyd	Apr. 5, 1927
2,336,642	Schreck	Dec. 14, 1943
2,572,911	Brown	Oct. 30, 1951
2,874,591	Thoma	Feb. 24, 1959

April 5, 1927. 1,623,929

J. LOYD

STEERING BY DRIVING MEANS FOR VEHICLES

Filed Nov. 12, 1924 4 Sheets-Sheet 1

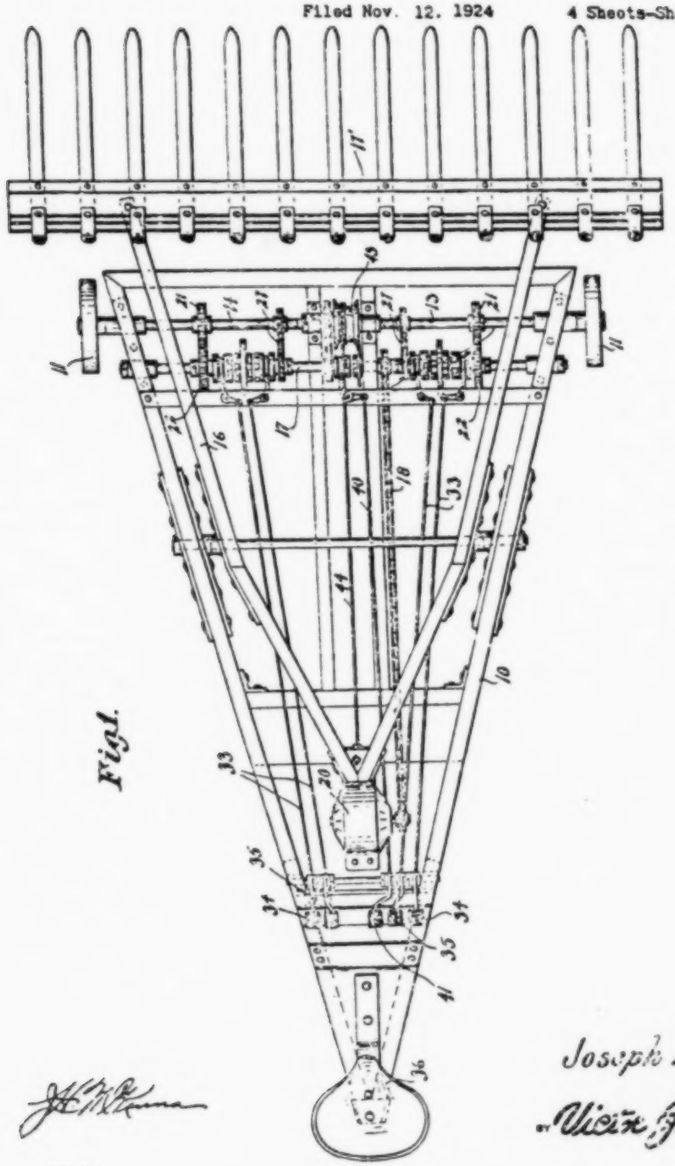


Fig.1.

Joseph Loyd,
INVENTOR
Victor J. Evans,
ATTORNEY

WITNESS:

Ex 84
CLARK

April 5, 1927. 1,623,929

J. LOYD

STEERING BY DRIVING MEANS FOR VEHICLES

Filed Nov. 12, 1924 4 Sheets-Sheet 2

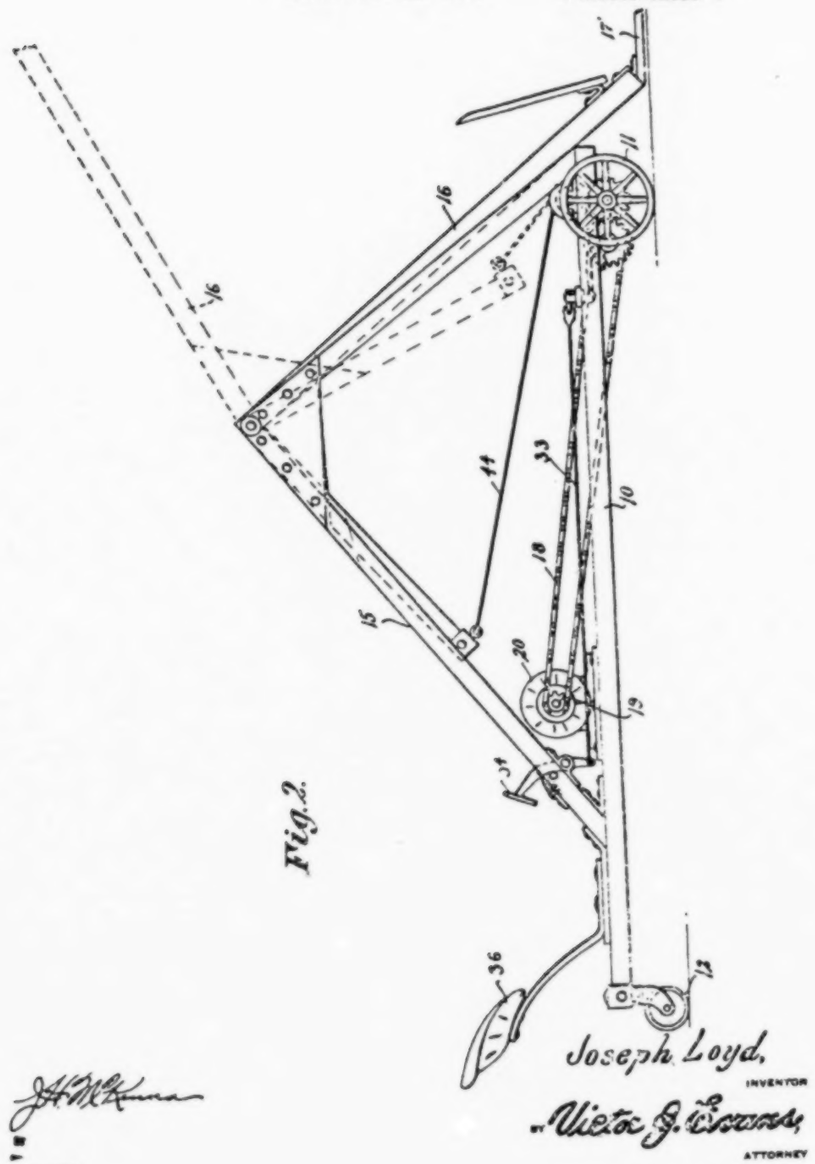


Fig.2.

Joseph Loyd,
INVENTOR
Victor J. Evans,
ATTORNEY

WITNESS:

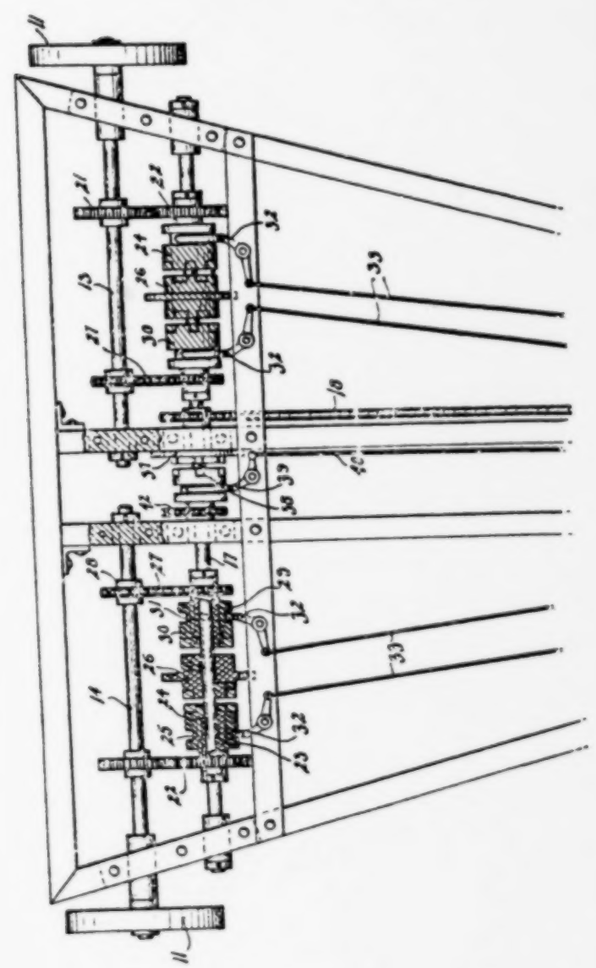
April 5, 1927. 1,623,929

J. LOYD

STEERING BY DRIVING MEANS FOR VEHICLES

Filed Nov. 12, 1924 4 Sheets-Sheet 3

Fig. 3.



Joseph Loyd,
INVENTOR
Victor J. Evans,
ATTORNEY

WITNESS:

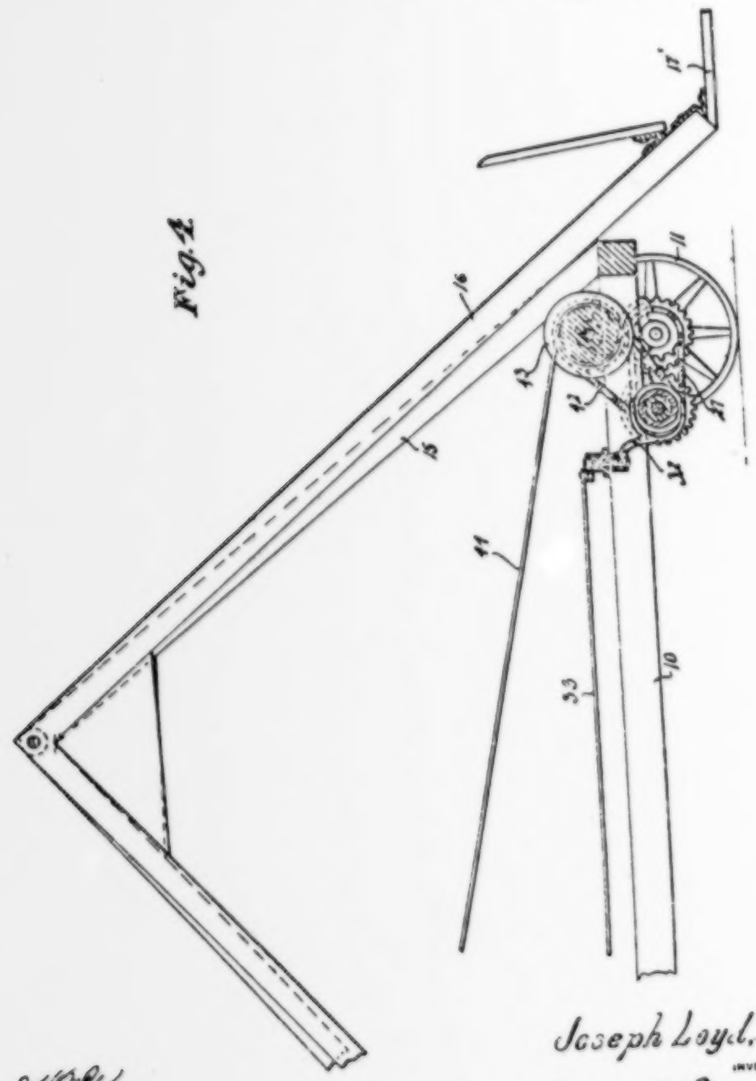
April 5, 1927. 1,623,929

J. LOYD

STEERING BY DRIVING MEANS FOR VEHICLES

Filed Nov. 12, 1924 4 Sheets-Sheet 4

Fig. 4.



Joseph Loyd,
INVENTOR
Victor J. Evans,
ATTORNEY

WITNESS:

Patented Apr. 5, 1927. 1,623,929

UNITED STATES PATENT OFFICE.

JOSEPH LOYD, OF BROKEN BOW, NEBRASKA.

STEERING BY DRIVING MEANS FOR VEHICLES.

Application filed November 12, 1924. Serial No. 749,537.

This invention contemplates the provision of means for steering a machine through the instrumentality of a plurality of clutches and pedals, by means of which the front wheels of the machine can be rotated in the same or reverse directions as the occasion may require.

Another object of the invention resides in the provision of means for propelling and steering a machine wherein the axles for the ground engaging wheels are capable of being rotated in the same or opposite directions, the invention being primarily intended for use in conjunction with a hay stacker, wherein a rack can also be raised or lowered by a food controlled clutch mechanism.

The nature and advantages of the invention will be better understood when the following detailed description is read in connection with the accompanying drawings, the invention residing in the construction, combination and arrangement of parts as claimed.

In the drawings forming part of this application, like numerals of reference indicate similar parts in the several views, and wherein:

Figure 1 is a top plan view of a hay stacker embodying the subject matter of the present invention.

Figure 2 is a side elevation showing the elevated position of the hay fork by dotted lines.

Figure 3 is a fragmentary plan view showing the clutch arranged for rotating the axles in the manner above specified.

Figure 4 is a sectional view taken on the line 4—4 of Figure 1.

Referring to the drawing in detail, 10 represents the frame of a hay stacker, the frame being mounted on wheels 11 which are arranged at the front thereof, and on a caster or the like 12 which is arranged at the rear end of the frame, the latter being of substantially triangular formation in plan as shown in Figure 1. Each wheel 11 is provided with an axle, and these axles are indicated at 13 and 14 respectively, being journalled in suitable bearings as clearly illustrated in Figure 3. Mounted on the main frame 10 and rising therefrom is an auxiliary frame 15 which is substantially of inverted V shaped formation, and pivoted on this auxiliary frame is a movable frame 16 of similar contour, which movable frame carries the hay fork indicated generally at 17'. The fork carrying frame 16 is of course pivoted on the frame 15 at the apex thereof, so that the fork 17' can either occupy its normal position shown by full lines in Figure 2, or be elevated to the position illustrated by the dotted line position of the movable frame 16 shown in Figure 3. Journalled on the main frame 10 directly behind and parallel with the axles above referred to is a driven shaft 17, this shaft being driven by an endless chain 18 which is trained over a sprocket carried by the shaft 17, and a similar sprocket carried by a motor shaft 19, the motor being indicated generally at 20. The shaft 17 drives the axles 13 and 14 respectively, a series of clutches being employed for this purpose, and arranged to be selectively used, to rotate both axles simultaneously in either a forward or rearward direction, or to rotate said axles relatively in opposite directions.

Upon inspection of Figure 3, it will be noted that each of the axles is provided with a gear 21 which meshes with a similar gear 22 fixed upon the shaft 17. Each gear 22 is carried by a sleeve 23, and slidably mounted on each sleeve is a clutch member 24 which is also connected with the sleeve by means of a key 25. Each clutch member 24 is normally spaced from a cooperating clutch member 26 which is fixed to the shaft 17. Each axle is also connected with the shaft 17 by means of sprockets and an endless chain, the latter being indicated at 27, and trained over a sprocket 28 fixed on the adjacent axle and a similar sprocket carried by a sleeve 29 which is fixed on the shaft 17. Arranged to slide on this sleeve 29 is a clutch member 30 which is also keyed to the sleeve as at 31, the clutch member 30 being normally spaced from the clutch member 26 above referred to. Manifestly, the axles 13 and 14 can be driven from the shaft 17 either through the gears 21 and 22 or by the chain 27, this depending upon which of the movable clutch members 24 and 26 respectively are moved into operative association with the clutch member 26. As shown in Figure 3, each sliding clutch member has associated therewith a pivoted arm 32 which is connected with the adjacent end of a rod 33, and each rod in turn is connected with a foot pedal as shown in Figure 1. Consequently, there is a pair of foot pedals 34 and 35 respectively for the clutch members 24 and 30, and each side of the frame,

and adjacent the driver's seat indicated at 36. These pedals are used selectively to rotate the axles 13 and 14 in the desired direction. For instance, when it is desired to rotate the axles 13 and 14 in a forward direction, the pedals 34 at the opposite sides of the machine are depressed, thereby moving the corresponding clutch members 24 into operative association with the adjacent clutch member 26, whereupon the gears 21 and 22 are employed to rotate the axles 13 and 14 in a forward direction. If it is desired to reverse the machine, the pedals 35 are depressed, thus throwing the corresponding clutch members 30 for the respective axles into operative association with the adjacent clutch member 26. Under these circumstances the axles 13 and 14 are rotated in a reverse direction through the instrumentality of the endless chains 27. When the clutch members are used in the manner just described, the clutches are used for propelling the machine in either a forward or rearward direction, which by reason of the construction and arrangement of parts, it is manifest that the clutches can also be used for steering the machine. In other words, the axles 13 and 14 are rotated in relatively opposite directions to allow the machine to make a short turn either to the right or to the left, and this is accomplished by using one of the clutch members 24 with the adjacent clutch member 26, and one of the clutch members 30 with its adjacent clutch member 26 at one and the same time. By depressing the pedal 34 at the right hand side of the machine, the axle 13 is rotated in a forward direction through the gears 21 and 22, while simultaneously depressing the clutch pedal 35 at the other side of the machine, will rotate the axle 14 in an opposite direction through the chain drive 27.

In addition to the clutches above described, the shaft 17 is also provided with a clutch member 37 arranged centrally on said shaft, while cooperating with this clutch 37 is a normally spaced sliding clutch member 38. The clutch member 38 has associated therewith a pivoted arm 39 which is connected with the adjacent end of the rod 40, the rod being actuated by means of a foot pedal 41 disposed adjacent one pair of pedals above referred to. When this pedal 41 is depressed, the clutch member 38 is moved into operative association with the clutch member 37, whereupon both clutch members rotate in unison. The clutch member 38 is employed to drive an endless chain 42, which is trained over a sprocket carried by the hub of a drum 43 which has connected therewith a flexible element 44 employed to raise or lower the fork carrying frame 16. In other words, the flexible element 44 is adapted to be wound about and unwound from the drum 43, and when the clutch member 38 is moved into operative association with the clutch member 37, the drum is rotated in a direction to wind the flexible element 44 thereabout thus exerting a pull upon the movable frame 16 to elevate the fork in the manner indicated; dotted line position of the frame in Figure 2. While the means for propelling and steering the machine is shown in connection with a hay stacking machine, I desire to have it understood that the invention can be used in connection with other types of machines, and that its general application is contemplated by the claim.

While it is believed that from the foregoing description, the nature and advantages of the invention will be readily apparent, I desire to have it understood that I do not limit myself to what is herein shown and described, and that such changes may be resorted to when desired as fall within the scope of what is claimed.

Having thus described the invention, I claim:

In combination, a wheeled frame, a pair of aligned axles journaled thereon, a driven shaft arranged at one side and in parallelism with the axles, a gear carried by each axle, a central clutch member mounted on the shaft for each axle, a pair of cooperating clutch members slidably mounted on the shaft and arranged at the opposite sides of the central clutch member, an endless chain providing a driving connection between one of the cooperating clutch members and the adjacent axle, a gear carried by the other cooperating clutch member of each pair and meshing with the gear of the adjacent axle, pivoted arms associated with the cooperating clutch members, operating rods connected with the said arms, foot pedals associated with said rods, whereby said cooperating clutch members can be selectively actuated to rotate said axles in the same direction or in relatively different directions, an additional clutch member arranged centrally of the shaft, a cooperating sliding clutch member normally spaced from the last mentioned member, and pedal actuated means for controlling the sliding clutch member.

In testimony whereof I affix my signature.

JOSEPH LOYD.

Dec. 14, 1943. I. F. SCHRECK 2,336,642

TRACTOR UNIT FOR INDUSTRIAL TRUCKS

Filed Oct. 7, 1941 2 Sheets-Sheet 1

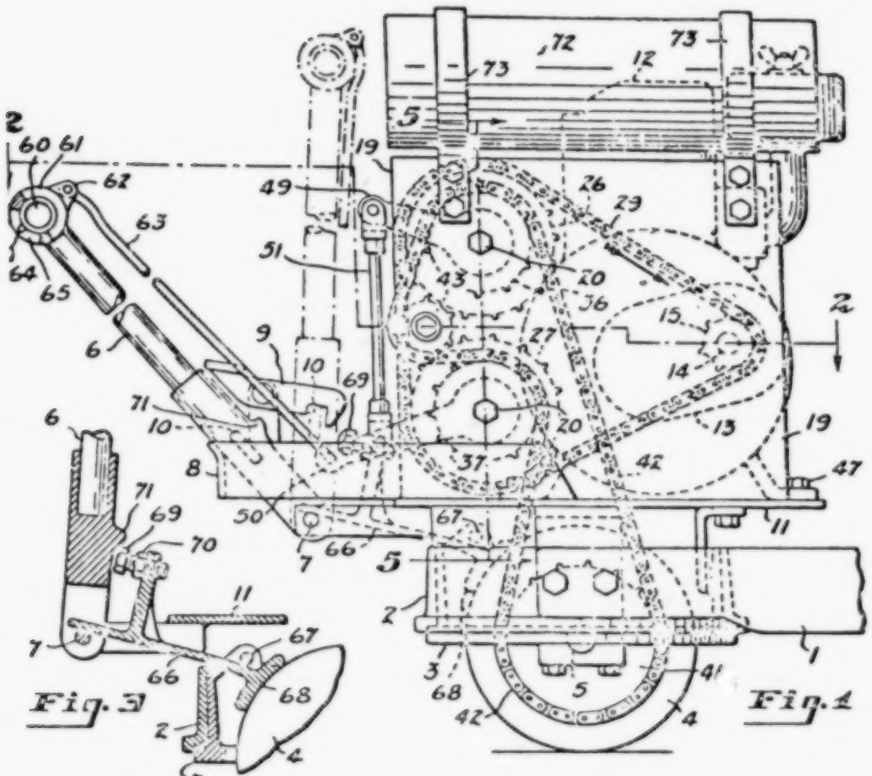


Fig. 3

Fig. 1

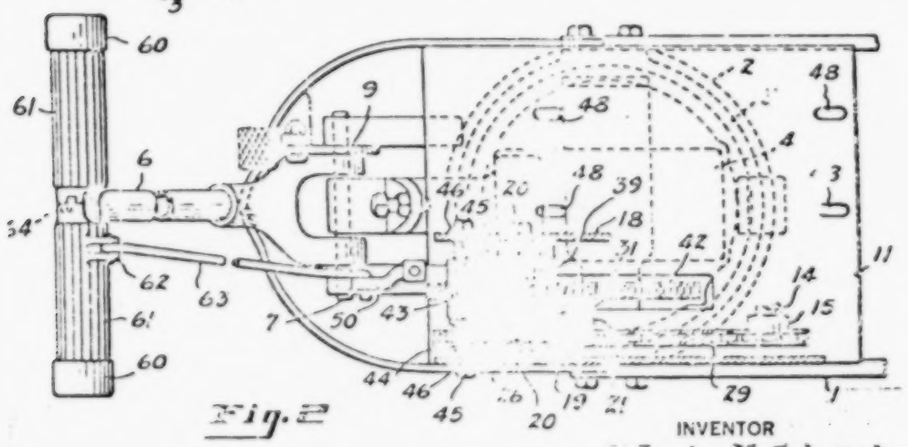


Fig. 2

INVENTOR
Irvin F. Schreck
BY Frank S. Greene
ATTORNEY

Ex. 85
CLARK

Dec. 14, 1943. I. F. SCHRECK 2,336,642

TRACTOR UNIT FOR INDUSTRIAL TRUCKS

Filed Oct. 7, 1941 2 Sheets-Sheet 2

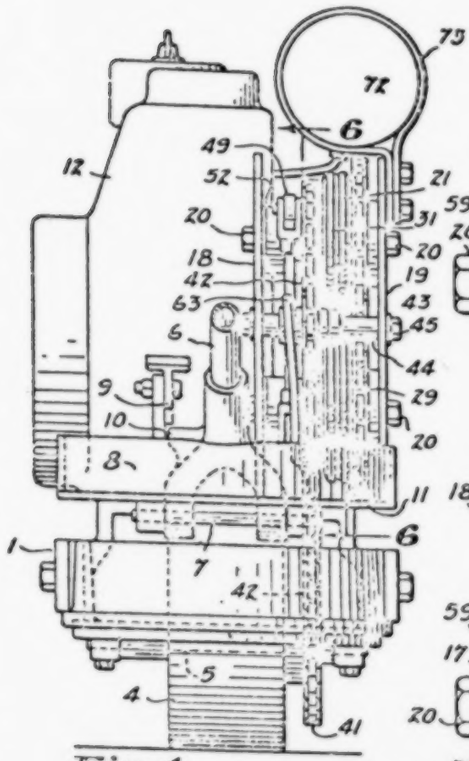


Fig. 4

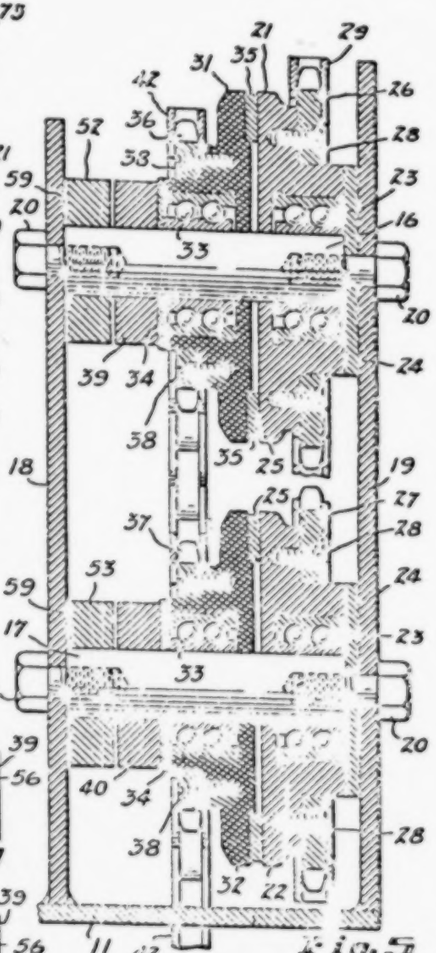


Fig. 5

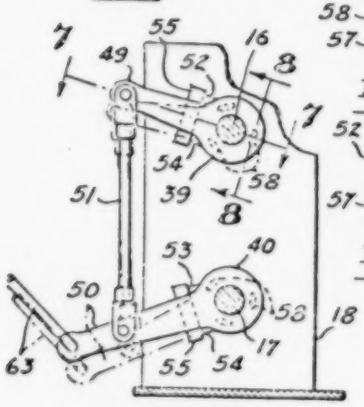


Fig. 6

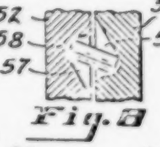


Fig. 8

Fig. 9

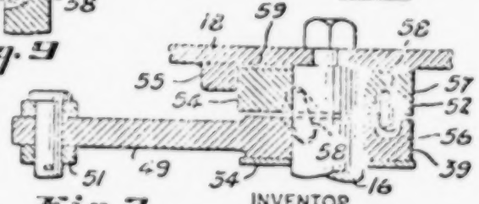


Fig. 7

INVENTOR
Irvin F. Schreck
BY Frank S. Greene
ATTORNEY

Patented Dec. 14, 1943

2,336,642

UNITED STATES PATENT OFFICE

2,336,642

TRACTOR UNIT FOR INDUSTRIAL TRUCKS

Irvin F. Schreck, Cleveland Heights, Ohio

Application October 7, 1941, Serial No. 413,908

15 Claims. (Cl. 180—13)

This invention relates to tractor units for industrial trucks and, more particularly, to the propelling mechanism and the controlling means therefor.

The invention has for an object to provide a tractor unit in which the traction wheel driving mechanism consists of a driving motor and a clutch controlled, reversible driving mechanism interposed between the motor and wheel, and in which the motor and mechanism are compactly mounted upon a relatively small supporting platform on the frame of the unit adjacent the traction wheel with the reversible driving mechanism occupying a narrow space alongside the motor.

The invention has for a further object to provide an inexpensive and compact clutch controlled, reversible driving mechanism for a tractor unit which is adapted to be controlled by a simple, manually operable clutch actuator.

A further object is to provide the tractor unit with a draft tongue by means of which the truck may be drawn manually, the tongue having clutch controlling means mounted thereon, by which the operation of the driving mechanism may be controlled by the operator.

A further object is to control the reversing mechanism by swinging movements of the draft tongue in such manner that the truck cannot be propelled toward the operator when the draft tongue is moved to its uppermost position, but which will permit the truck to be propelled in a rearward direction with the draft tongue in its uppermost position.

Further objects are to provide a clutch controlled reversing drive for the traction wheel through friction clutch elements which have only a slight axial movement between their engaged and disengaged positions and which free themselves as soon as axial pressure is released, and to provide simple and conveniently operable means for controlling such clutches.

A further object is to provide a simple chain and sprocket drive for the traction wheel, which includes a clutch operated reversing means.

With the above and other objects in view, the invention may be said to comprise the traction unit as illustrated in the accompanying drawings, hereinafter described, and particularly set forth in the appended claims, together with such variations and modifications thereof that will be apparent to one skilled in the art to which the invention pertains.

Reference should be had to the accompanying drawings forming a part of the specification, in which:

Figure 1 is a side elevation of a tractor unit embodying the invention and showing the tractor unit mounted in the forward end of a truck frame;

Fig. 2 is a horizontal section taken on the line indicated at 2—2 in Fig. 1 looking downwardly, the engine being removed in this view;

Fig. 3 is a fragmentary detail view showing the tongue operated brake in vertical section;

Fig. 4 is a front elevation of the tractor unit;

Fig. 5 is a section on an enlarged scale taken on the line indicated at 5—5 in Fig. 1;

Fig. 6 is a section taken on the line indicated at 6—6 in Fig. 4;

Fig. 7 is a sectional view on an enlarged scale taken on the line indicated at 7—7 in Fig. 6;

Fig. 8 is a section on an enlarged scale taken on the line indicated at 8—8 in Fig. 6; and

Fig. 9 is a section similar to Fig. 8 showing the shifter collar and thrust pin in clutch engaging position.

Referring to the accompanying drawings, the tractor unit of the present invention is shown mounted in the forward end of a truck frame 1. The tractor unit is mounted in the truck frame 1 to turn about a vertical axis, the frame 3 of the tractor unit being rotatably mounted in an annular bearing member 2 at the forward end of the frame 1 and being provided with an annular bearing portion which fits within the bearing portion 2 of the truck frame. A traction wheel 4 has an axle 5 mounted on the annular bearing member 3, so that the wheel 4 is a steering wheel as well as a traction wheel. The mounting of the tractor unit in the truck frame is substantially the same as in the truck shown and described in my Patent No. 2,209,353, granted July 30, 1940.

A draft tongue 6 is connected by a horizontal pivot 7 to the tractor unit frame 3 and by means of this tongue the tractor unit may be turned within the bearing portion 2 of the truck frame to steer the truck, and the truck may be drawn forwardly or pushed rearwardly by means of the tongue 6, when desired. The downward movement of the tongue 6 is limited by engagement of the tongue with a bumper bar 8 at the forward end of the tractor unit frame 3 and the tongue may be detachably secured in its uppermost, substantially vertical position by means of a latch 9 pivotally mounted on the bumper bar 8 and loosely engaging a lug 10 adjacent the rearward end of the tongue 6.

The tractor unit frame has a platform 11 which provides a support for a driving motor 12, which may be an internal combustion engine. Through

suitable gearing in a reduction gear housing 13, the motor 12 drives a horizontal shaft 14 above the rear end portion platform 11, the shaft 14 having a sprocket 15 attached thereto, through which the propelling mechanism is driven. Forwardly of the shaft 14, two vertically spaced shafts 16 and 17 are mounted between inner and outer uprights 18 and 19 attached to the platform 11. The outer upright 19 is in the form of a plate extending substantially the full length of the platform 11 along an edge thereof. The inner upright 18 is a narrower plate disposed between a portion of the motor 12 and the forward end of the platform 11. The shafts 16 and 17 are clamped between the uprights 18 and 19 by means of bolts 20 which extend through the uprights 18 and 19 and screw into threaded bores in the ends of the shafts.

Adjacent the outer upright 19, clutch elements in the form of friction disks 21 and 22 are rotatably mounted upon the shafts 16 and 17. The disks 21 and 22 are provided with ball thrust bearings 23, the inner rings of which bear against washers 24 clamped between the upright 19 and the outer ends of the shafts 16 and 17. On their inner sides, the disks 21 and 22 have flat friction faces 25, and to the outer sides of the disks sprockets 26 and 27 are rigidly attached to the disks 21 and 22 by means of screws 28. A sprocket chain 29 extends over the sprockets 15, 26 and 27 so that when the sprocket 15 is driven by the motor 12, the sprockets 26 and 27 are continuously rotated in the same direction. Adjacent to and inwardly of the clutch disks 21 and 22, clutch disks 31 and 32 are mounted, disks 21 and 31 providing a pair of coacting clutch elements on the upper shaft 16 and the disks 22 and 32 providing a similar pair of clutch elements on the shaft 17. The disks 31 and 32 are provided with ball thrust bearings 33, the inner races of which are slidable on the shafts 16 and 17 and engageable with thrust washers 34 on the shafts 16 and 17. The disks 31 and 32 are provided with flat facing rings 35 composed of suitable friction material which are engageable with the faces 25 of the disks 21 and 22. By pressing either of the disks 31 or 32 axially toward the opposed disks 21 or 22, either of the disks 31 or 32 may be caused to turn in unison with the motor driven disk on its shaft. Sprockets 36 and 37 are rigidly attached to the disks 31 and 32 by means of screws 38. The clutch disk 31 of the upper pair is adapted to be pressed into engagement with the disk 21 by means of a shifter collar 39 slidable on the shaft 16; and the disk 32 on the lower shaft 17 is adapted to be pressed into clutching engagement with the disk 22 by means of a shifter collar 40 slidably mounted on the shaft 17 immediately beneath the collar 39.

A sprocket 41 is attached to the traction wheel 4 and a sprocket chain 42 extends around the sprocket 36 on the upper shaft 16 and the sprocket 41. An idler sprocket 43 is mounted on a horizontal shaft 44 and is positioned intermediate the shafts 16 and 17 and forwardly thereof. The sprocket chain 42 extends over the idler sprocket 43 and rearwardly therefrom with its exterior engaging the sprocket 37 on the shaft 17 through an arc of contact sufficient for effective driving engagement. When the upper pair of clutch elements 21 and 31 are engaged, the sprockets 26 and 36 are simultaneously rotated in the same direction and the chain 42 and the traction wheel 4 are driven through the sprocket 36. When the pair of clutch elements 22 and 32 on the lower shaft 17 are engaged, the sprockets 27 and 37 are rotated in unison and the chain 42 is driven through the sprocket 37. By reason of the fact that the sprocket 36 engages the interior of the sprocket chain 42 while the sprocket 37 engages the exterior of the sprocket chain 42, the chain 42 is driven in one direction through the sprocket 36 when the sprocket 36 is clutched to the sprocket 26 and in the opposite direction through the sprocket 37 when the sprocket 37 is clutched to the sprocket 27.

In order to maintain the proper tension in the sprocket chain 42, the sprocket 43 may be mounted in any suitable way for horizontal adjustment. As herein shown, the sprocket 43 is mounted on a shaft 44 which is clamped between the uprights 18 and 19 by means of bolts 45 extending through horizontal slots 46 in the uprights 18 and 19. By properly positioning the bolts 45 in the slots 46 before clamping the shaft in place, the sprocket 43 may be adjusted to take up any slack in the sprocket chain 42. The engine is attached to the platform 11 by means of suitable anchoring bolts 47, which pass through longitudinal slots 48 in the platform. By adjusting the engine on the platform before tightening the bolts 47, the proper tension may be applied to the sprocket chain 26.

The shifter collars 39 and 40 have integral, forwardly extending arms 49 and 50 which are connected by a link 51 so that the collars 39 and 40 are constrained to turn simultaneously in the same direction. Stationary collars 52 and 53 are interposed between the shifter collars 39 and 40 and the inner supporting standard 18. The collars 52 and 53 are provided with peripheral projections 54 which engage with fixed lugs 55 on the supporting standard 18 to hold the collars 52 and 53 against turning movements on the shaft. The shifter collar 39 and adjacent stationary collar 52 on the upper shaft 16, and the shifter collar 40 and adjacent stationary collar 53 on the lower shaft 17 are provided on their opposed faces with circumferentially spaced recesses 56 and 57, which provide seats for opposite ends of thrust pins 58. The pins 58 between the two collars on each shaft are regularly spaced about the axis of the collars at an inclination to the opposed faces of the collars. The pins 58 engaging each of the shifter collars 39 and 40 are so disposed that upon turning movement of the collar in one direction the pins move toward a position parallel with the axis and exert an axial thrust on the collar. The thrust pins 58 engaging one shifter collar are inclined oppositely to the pins engaging the other shifter collar so that pressure is applied to one collar when it is turned in one direction and to the other collar when it is turned in the opposite direction. As illustrated in the drawings, the pins 58 interposed between the collars 39 and 52 move from the position shown in Fig. 8 to the position shown in Fig. 9 when the arms 49 and 50 are moved downwardly, exerting an axial pressure against the collar 39 and pressing the clutch element 31 into engagement with the clutch element 21. When the arms 49 and 50 are moved upwardly from the neutral position shown in full lines in Fig. 6, the thrust pins 58 interposed between the collars 40 and 53, which are oppositely disposed with respect to the pins between the collars on the upper shaft, apply axial pressure to the collar 40, engaging the clutch elements 22 and 32. Thus, by moving the arms 49 and 50 upwardly or down-

wardly, the truck may be propelled in a forward or a rearward direction.

Only a very slight clearance is necessary between the clutch disks and the actuating collars need have very little axial movement since axial pressure is necessary to maintain driving engagement between the friction clutch elements. Since the clutch actuating collars are actuated by turning movements in a vertical direction, the entire reversible driving mechanism may be mounted in the narrow space between the uprights 18 and 19. In order to properly position the clutch elements and to compensate for wear between the friction faces of the clutch elements, shims 59 may be inserted between the thrust collars 52 and 53 and the supporting standard 18.

At its forward end the draft tongue 6 is provided with a transverse handgrip portion 60, upon which is rotatably mounted a sleeve 61. The sleeve 61 has a projecting lug 62, to which one end of a rod 63 is pivotally attached. The opposite end of the rod 63 is pivotally connected to the outer end of the lower forwardly projecting arm 50. The operator by gripping the sleeve 61 and turning the same in a counterclockwise direction, as viewed in Fig. 1, lifts the arms 49 and 50, clutching the sprocket 37 to the sprocket 27 to propel the truck forwardly. Upon turning movement of the sleeve 61 in a clockwise direction, the arms 49 and 50 are moved downwardly to clutch the sprocket 36 to the sprocket 26 to propel the truck rearwardly.

Whenever the truck tends to overtake the operator walking ahead of the truck holding the handgrip of the tongue, the tongue 6 will be moved towards vertical position and means is provided for controlling the operation of the driving mechanism by the tongue to automatically move the clutch actuators to neutral position to prevent injury to an operator, the operating connections being so arranged that when the tongue approaches its uppermost position, as shown in dotted lines in Fig. 1, the shifter collars are held against movement in a direction to engage the clutch through which the truck is propelled forwardly. Suitable means is provided for limiting the turning movements of the sleeve 61 with respect to the handgrip 60, so that in the uppermost position of the tongue the sleeve 61 is normally in its neutral position and is movable in one direction only from its neutral position. As shown in Fig. 1 of the drawings, the rod 63 bears against the sleeve 61 when the rod is in vertical position and prevents turning of the sleeve in a counterclockwise direction. To provide for disengagement of the clutch through which the truck is propelled forwardly at the desired point in the movement of the draft tongue, the handgrip portion 60 of the tongue may be provided with a radial pin 64, which extends through an arcuate slot 65 in the sleeve 61. The pivotal connection between the arm 50 and the actuating rod 63 is spaced from the pivot 7 of the tongue so that vertical swinging movements of the tongue 6 cause the handgrip portion 60 to turn within the sleeve 61. The pin 64 and the slot 65 are so arranged that when the tongue approaches its uppermost position the pin 64 engages with an end of the slot 65, so that further turning movement of the handgrip 60 within the sleeve is prevented. The range of movement of the actuating members on the tongue is thus positively restricted to a movement from neutral position to a position engaging the clutch through which the truck is propelled rearwardly and the lifting of the arms 49 and 50 to clutch the sprockets 27 and 37 is prevented, so that with the tongue in this position the truck cannot be propelled forwardly. The sleeve 61, however, is free to turn in a clockwise direction when the tongue is in its uppermost position, so that the operator may cause the truck to be propelled rearwardly when the handle is in this position.

To enable the operator to bring the truck quickly to a stop, a brake is provided which is controlled by the draft tongue 6. The brake device comprises a bar 66 which is slidably mounted on the frame 2 and guided by the pivot 7, and a pin 67 on the frame 3 adjacent the periphery of the wheel, the bar 66 carrying a brake shoe 68 which is brought into engagement with the periphery of the wheel upon a pivotal movement of the tongue 6. The bar 66 carries an adjustable abutment in the form of a screw 69, which is adapted to be secured in adjusted position by means of a nut 70. The head of the screw 69 is in the path of movement of a lug 71 on the tongue 6 and is engaged by the lug 71 as the tongue 6 approaches its vertical position. By pressing the upper end of the tongue 6 toward the truck, pressure is applied through the bar 66 to the brake shoe 68 bearing against the periphery of the wheel 4. Sufficient play is provided between the latch 9 and lug 10 with the latch in locking position to permit the application of the brake. Upon release of the pressure exerted by the draft tongue the brake is brushed away from the wheel tread when the wheel rotates.

A fuel tank 72 may be mounted upon the upper end of the outer standard 18 and suitable bracket 73 attached to the standard.

The operator by gripping the sleeve 61 and exerting a forward pull on the draft tongue can, with little effort, turn the sleeve in a direction to exert a pull upon the rod 63, lift the arms 49 and 50, and engage the lower clutch to propel the truck forwardly. Likewise, by gripping the sleeve 61 and exerting a rearward push, the rod 63 is actuated with little effort to move the arms 49 and 50 downwardly and engage the upper clutch to propel the truck rearwardly. By maintaining his grip on the sleeve 61 after initial actuation, the necessary pressure may be maintained upon the engaged clutch element. At any time the traction wheel may be released from the driving mechanism by merely releasing the sleeve 61 and the truck may be quickly stopped by swinging the draft tongue to brake applying position

The present invention provides a simple and compact self-propelled tractor unit having a clutch controlled reversing mechanism controlled by actuators which are directly connected to operating members on the draft tongue in such a way as to provide a convenient and safe control of the driving mechanism by an operator walking in the direction of travel of the truck and guiding its movement by means of the draft tongue.

It is to be understood that variations and modifications of the specific devices herein shown and described for purposes of illustration, may be made without departing from the spirit of the invention.

What I claim is:

1. A tractor unit comprising a frame, a traction wheel journaled in the frame, a draft tongue pivoted at its rearward end to the frame to swing about a horizontal axis, a motor carried by the frame, means for driving the traction wheel from

said motor including a clutch controlled reversing mechanism, means for operating said clutches including an operating member mounted for movement in either direction from a neutral position to cause said unit to be propelled forwardly or rearwardly, an actuating member movably mounted on said tongue, a rod connected to said actuating member and pivoted to said clutch operating member laterally of the pivotal axis of the tongue whereby said actuating member is moved relatively to the tongue upon a swinging movement of said tongue, and means for limiting the movement of the actuating member in one direction with respect to the tongue to restrict the movement of said clutch operating member to a movement in one direction from neutral position when said tongue is in its uppermost position.

2. A tractor unit comprising a frame, a traction wheel journaled in the frame, a draft tongue pivoted at its rearward end to the frame to swing about a horizontal axis, a motor carried by the frame, means for driving the traction wheel from said motor including a clutch controlled reversing mechanism, means for operating said clutches including an operating member mounted for movement in either direction from a neutral position to cause said unit to be propelled forwardly or rearwardly, an actuating member mounted upon said tongue and operably connected to said clutch operating member to actuate the same in either direction, and means controlled by swinging movements of said tongue for preventing actuation of said clutch operating member in a direction to propel said unit forwardly when said tongue is in its uppermost position.

3. A tractor unit comprising a frame, a traction wheel journaled in the frame, a draft tongue connected at its rearward end to said frame to swing about a horizontal axis, said tongue having a transverse handgrip portion adjacent its forward end, a motor carried by the frame, means for driving the traction wheel from said motor including a clutch controlled reversing mechanism, means for operating said clutches including a clutch operating member mounted for movement in either direction from a neutral position to cause the unit to be propelled forwardly or rearwardly, a sleeve rotatably mounted on said handgrip portion, an actuating rod connected eccentrically to said sleeve and pivoted to said clutch operating member laterally of the pivotal axis of the tongue whereby said handgrip portion turns within said sleeve as said tongue is swung vertically, and means for limiting the turning movement of the sleeve with respect to said hand grip to restrict the movement of said clutch operating member to a movement in one direction from neutral position when said draft tongue is in its uppermost position.

4. A tractor unit comprising a supporting frame, a traction wheel, a draft tongue connected at its rearward end to said frame to swing about a horizontal axis, said tongue having a transverse handgrip portion adjacent its forward end, a motor mounted on the frame, means including a clutch controlled reversing mechanism for driving said traction wheel from said motor, means for operating said clutches including a vertically movable clutch operating member movable upwardly or downwardly from a neutral position to propel the unit forwardly or rearwardly, a sleeve rotatably mounted on said handgrip portion, an actuating rod connected eccentrically to said sleeve and pivoted to said clutch operating member, the pivot connecting said rod and clutch operating member being spaced from the pivotal axis of the tongue, whereby said handgrip portion turns within the sleeve as the draft tongue is swung vertically, and means for limiting the turning movement of the sleeve with respect to the handgrip portion to restrict the range of movement of said control member when said draft tongue is in its uppermost position to a movement downwardly from neutral position.

5. A tractor unit comprising a frame, a motor carried by the frame, a traction wheel journaled in the frame, a draft tongue pivoted to the frame, two spaced parallel shafts mounted in the frame, a pair of clutch elements mounted on each shaft, a driving connection between said motor and one clutch element of each pair for continuously rotating the latter clutch elements, a driving connection between each of the other two clutch elements and said wheel, one of said driving connections being a reverse driving connection, clutch operating means including an actuating member movable in one direction from a neutral position to engage the clutch elements of one pair and in the opposite direction from said neutral position to engage the clutch elements of the other pair, whereby said wheel may be driven in a forward or reverse direction, and means carried by said draft tongue for operating said actuating member.

6. A tractor unit comprising a frame, a motor carried by the frame, a traction wheel journaled in the frame, a draft tongue pivoted to the frame, two spaced horizontal shafts mounted in the frame, a pair of clutch elements having opposed friction faces mounted side by side on each shaft, one clutch element of each pair being slidable upon the shaft to engage or disengage said friction faces, a driving connection between the motor and one clutch element of each pair for continuously rotating the latter clutch elements, a driving connection between each of the other two clutch elements and said wheel, one of said driving connections being a reverse driving connection, means for pressing together the friction faces of the clutch elements of either pair including an actuating member movable in one direction from a neutral position to engage the clutch elements of one pair in the other direction from said neutral position to engage the clutch elements of the other pair, whereby said wheel may be driven in a forward or reverse direction and means carried by said tongue for operating said actuating member.

7. A tractor unit comprising a frame, a motor carried by the frame, a traction wheel journaled in the frame, a draft tongue pivoted to the frame, two spaced horizontal shafts mounted in the frame, a pair of clutch elements having opposed friction faces mounted side by side on each shaft, one clutch element of each pair being slidable upon the shaft to engage or disengage said friction faces, a driving connection between the motor and one clutch element of each pair for continuously rotating the latter clutch elements, a driving connection between each of the other two clutch elements and said wheel, one of said driving connections being a reverse driving connection, a collar slidably and rotatably mounted on each of said shafts adjacent each of the slidable clutch elements, an arm attached to each collar, a link connecting said arms to cause the collars to turn simultaneously in the same di-

rection, means interposed between one collar and the frame for pressing said collar toward clutch engaging position upon a turning movement in one direction from a neutral position, means interposed between the other collar and the frame for pressing the latter collar toward clutch engaging position upon a turning movement in the opposite direction from said neutral position, an actuating member carried by said tongue and connected to one of said arms.

8. A tractor unit comprising a frame, a motor carried by the frame, a traction wheel journaled in the frame, a draft tongue pivoted to the frame, two spaced horizontal shafts mounted in the frame, a pair of clutch elements having opposed friction faces mounted side by side on each shaft, one clutch element of each pair being slidable upon the shaft to engage or disengage said friction faces, a driving connection between the motor and one clutch element of each pair for continuously rotating the latter clutch elements, a driving connection between each of the other two clutch elements and said wheel, one of said driving connections being a reverse driving connection, a collar slidably and rotatably mounted on each of said shafts adjacent each of the slidable clutch elements, an arm attached to each collar, a link connecting said arms to cause the collars to turn simultaneously in the same direction, means interposed between one collar and the frame for pressing said collar toward clutch engaging position upon a turning movement in one direction from a neutral position, means interposed between the other collar and the frame for pressing the latter collar toward clutch engaging position upon a turning movement in the opposite direction from said neutral position, a handgrip bar at the outer end of said tongue, a sleeve rotatably mounted on said bar, and an actuating rod connected at one end to said sleeve and at its opposite end to one of said arms.

9. A tractor unit comprising a frame, a motor carried by the frame, a traction wheel journaled in the frame, a draft tongue pivoted to the frame, two spaced horizontal shafts mounted in the frame, a pair of clutch elements having opposed friction faces mounted side by side on each shaft, one clutch element of each pair being slidable upon the shaft to engage or disengage said friction faces, a driving connection between the motor and one clutch element of each pair for continuously rotating the latter clutch elements, a driving connection between each of the other two clutch elements and said wheel, one of said driving connections being a reverse driving connection, a collar slidably and rotatably mounted on each of said shafts adjacent each of the slidable clutch elements, an arm attached to each collar, a link connecting said arms to cause the collars to turn simultaneously in the same direction, thrust pins interposed between said collars and the frame, said thrust pins being angularly movable upon turning movement of the collars and arranged to exert an axial thrust on one collar toward clutch engaging position upon a turning movement of the collars in one direction from a neutral position and to exert an axial thrust upon the other collar toward clutching position when the collars are turned in an opposite direction from said neutral position, an actuating member carried by said tongue and connected to one of said arms.

10. A tractor unit comprising a frame, a traction wheel journaled in the frame, a draft tongue pivoted at its rearward end to the frame to swing about a horizontal axis, a motor carried by the frame, means for driving the traction wheel from said motor including a clutch controlled reversing mechanism, two spaced parallel shafts mounted on said frame, means for driving said traction wheel to propel the unit forwardly including a pair of relatively movable friction clutch elements on one of said shafts, means for driving said traction wheel to propel the unit rearwardly including a pair of relatively movable friction clutch elements on the other shaft, a sleeve rotatably mounted on said handgrip portion, and means operated by said sleeve for engaging the clutch elements on one shaft upon a turning movement of the sleeve in one direction and for engaging the clutch elements on the other shaft upon a turning movement of the sleeve in the opposite direction.

11. A tractor unit comprising a frame, a traction wheel journaled in the frame, a draft tongue pivoted at its rearward end to the frame to swing about a horizontal axis, a motor carried by the frame, means for driving the traction wheel from said motor including a clutch controlled reversing mechanism, two spaced parallel shafts mounted on said frame, means for driving said traction wheel to propel the unit forwardly including a pair of relatively movable friction clutch elements on one of said shafts, means for driving said traction wheel to propel the unit rearwardly including a pair of relatively movable friction clutch elements on the other shaft, a sleeve rotatably mounted on said handgrip portion, and means controlled by pivotal movements of the tongue for holding one of said clutch elements out of engaging position.

12. A tractor unit for trucks comprising a frame, a motor carried by said frame, a traction wheel journaled in said frame, two spaced shafts mounted in the frame above and parallel with the axis of said wheel, a clutch element rotatably mounted on each of said shafts, means interposed between the motor and said clutch elements for driving both clutch elements in the same direction, a second clutch element rotatably mounted on each shaft alongside the motor driven clutch element, the two clutch elements on each shaft being relatively movable on the shaft into and out of clutching engagement, means for shifting said movable clutch elements including a movable operating member and means connecting said member to a clutch element of each pair operable to engage one pair of clutch elements upon movement of said member in one direction from a neutral position and to engage the other pair of clutch elements upon movement of said member in the opposite direction from said neutral position, a wheel driving sprocket, a sprocket attached to each of said second clutch elements, and a sprocket chain extending around said wheel driving sprocket and one of said clutch attached sprockets and having its exterior in driving engagement with the other of said clutch attached sprockets, whereby said traction wheel may be driven in one direction by one of said clutch attached sprockets or in the opposite direction by the other.

13. A tractor unit for trucks comprising a frame, a motor carried by said frame, a traction wheel journaled in said frame, two spaced parallel shafts mounted in the frame above and parallel with the axis of said wheel, a clutch element rotatably mounted on each of said shafts, means interposed between the motor and said clutch elements for driving both clutch elements in the same direction, a second clutch element rotatably mounted on each shaft alongside the motor driven clutch element, the two clutch elements on each shaft being relatively movable on the shaft into and out of clutching engagement, means for shifting said movable clutch elements including a movable operating member and means connecting said member to a clutch element of each pair operable to engage one pair of clutch elements upon movement of said member in one direction from a neutral position and to engage the other pair of clutch elements upon movement of said member in the opposite direction from said neutral position, a wheel driving sprocket, a sprocket attached to each of said second clutch elements, and a sprocket chain extending around said wheel driving sprocket and one of said clutch attached sprockets and having its exterior in driving engagement with the other of said clutch attached sprockets, whereby said traction wheel may be driven in one direction by one of said clutch attached sprockets or in the opposite direction by the other.

14. A tractor unit for trucks comprising a frame, a motor carried by the frame, a traction wheel journaled in the frame, a wheel driving sprocket, a motor driven sprocket, two spaced shafts mounted in the frame, a pair of sprockets rotatably mounted side by side on each of said shafts, the sprockets of each pair having opposed clutch elements attached thereto, one sprocket of each pair being slidable upon the shaft toward and away from the other sprocket of the pair to engage or disengage the clutch elements, a sprocket chain engaging one sprocket of each of said pairs and the motor driven sprocket, a second sprocket chain engaging the wheel driving sprocket and the other sprockets of said pairs, one of said chains extending around both the sprockets on said spaced shafts with which it engages, the other chain extending around the sprocket on one of said shafts with which it engages and having its exterior in driving engagement with the sprocket with which it engages on the other of said shafts, and means for shifting the movable sprocket of either of said pairs to clutch the sprockets of the pair together.

15. A tractor unit comprising a frame, a traction wheel journaled in the frame, a motor carried by the frame, two spaced parallel shafts mounted on said frame, means for driving said traction wheel to propel the unit forwardly including a pair of relatively movable friction clutch elements on one of said shafts, means for driving said traction wheel to propel the unit rearwardly including a pair of relatively movable friction clutch elements on the other shaft, a collar mounted to slide and turn on each of said shafts adjacent the movable clutch elements on each shaft, means associated with one collar for sliding the collar on the shaft to engage the adjacent pair of clutch elements upon turning movement in one direction, means associated with the second collar for sliding the same on the shaft to engage the other pair of clutch elements upon a turning movement in the opposite direction, and means for simultaneously turning the two collars in either direction to clutch one or the other pair of clutch elements.

IRVIN P. SCHRECK.

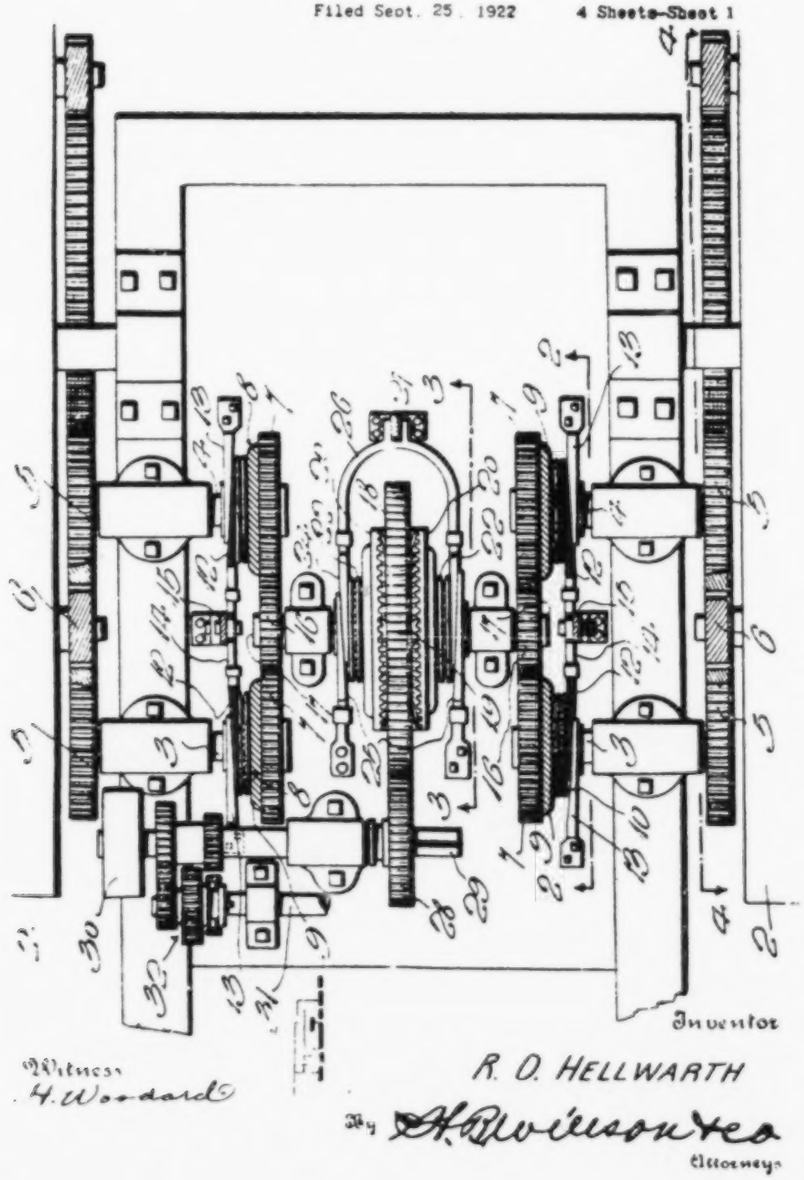
EX 86

Oct. 9, 1923. 1,470,078

R. O. HELLWARTH

TRANSMISSION MECHANISM

Filed Sept. 25, 1922 4 Sheets-Sheet 1



Witness
H. Woodard

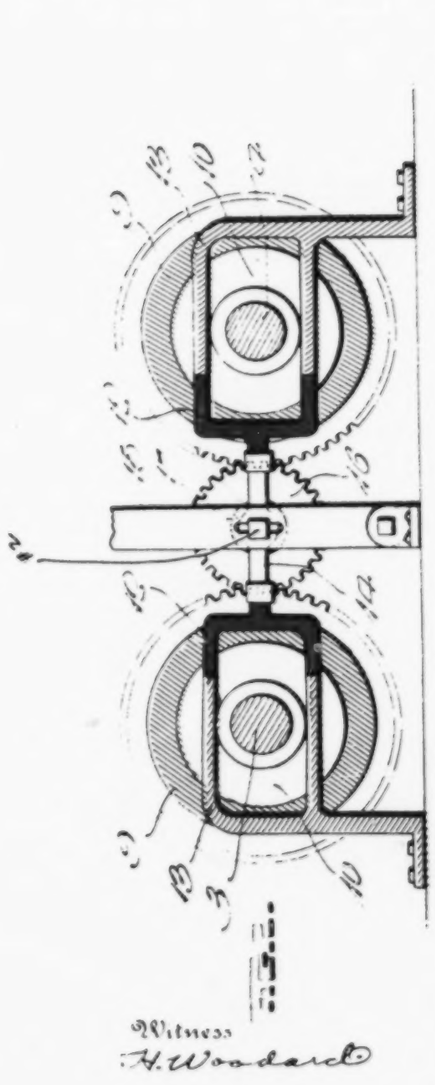
Inventor
R. O. HELLWARTH
By H. B. Wilson & Co
Attorneys

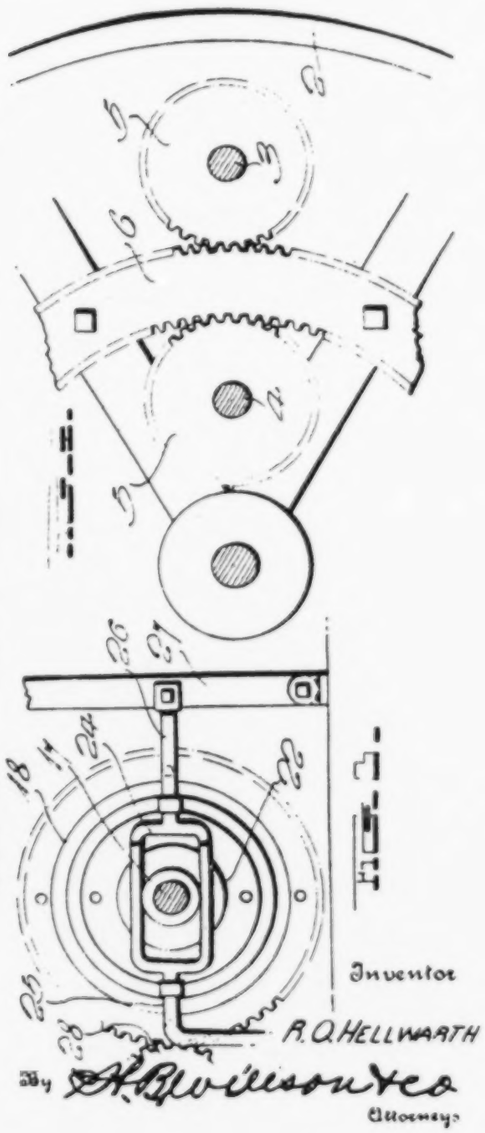
Oct. 9, 1923. 1,470,078

R. O. HELLWARTH

TRANSMIS ION MECHANISM

Filed Sept. 25, 1922 4 Sheets-Sheet 2





Witness
H. Woodard

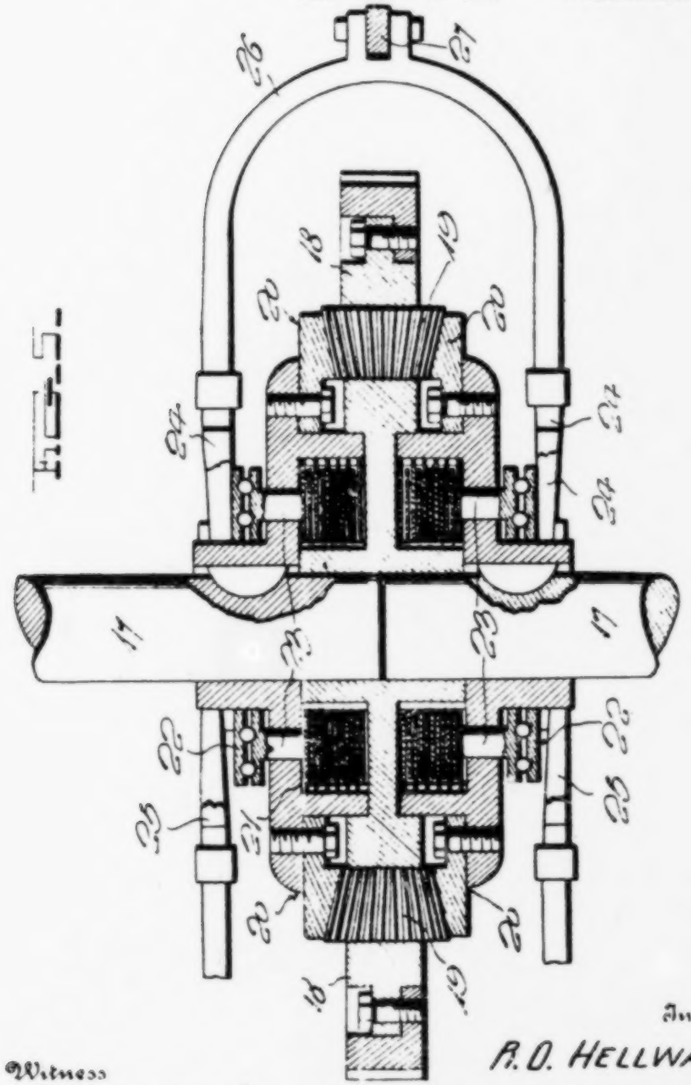
Inventor
R. O. HELLWARTH
By H. B. Wilson & Co
Attorneys

Oct. 9, 1923. 1,470,078

R. O. HELLWARTH

TRANSMISSION MECHANISM

Filed Sept. 25, 1922 4 Sheets-Sheet 3



Witness
H. Woodard

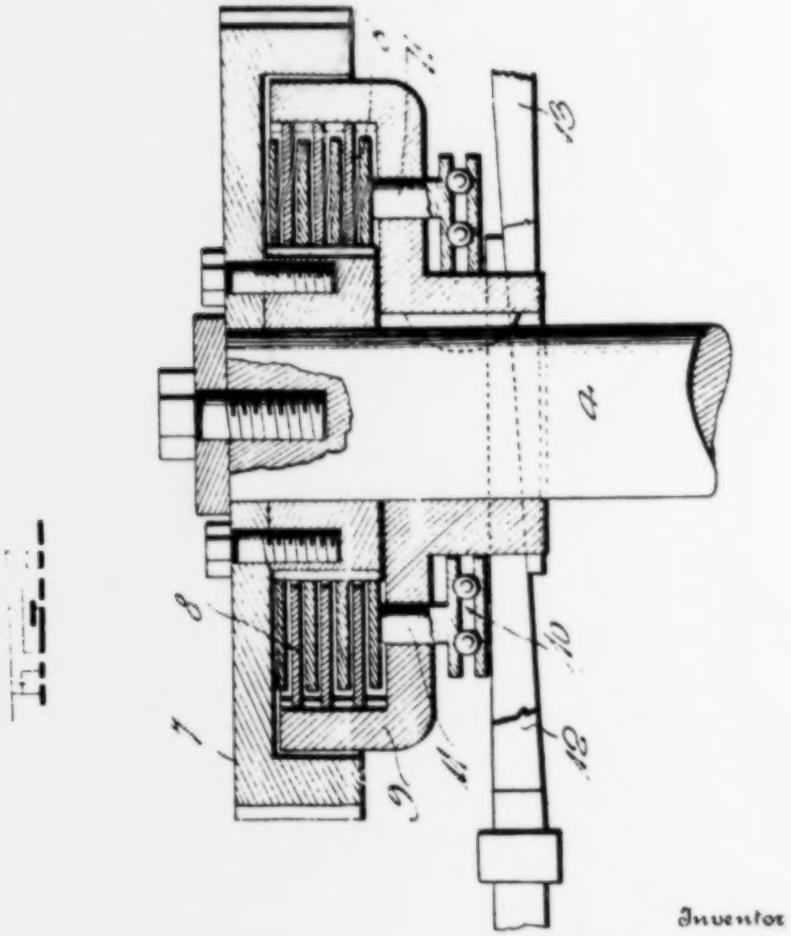
Inventor
R. O. HELLWARTH
By A. R. Williamson & Co
Attorney

Oct. 9, 1923. 1,470,078

R. O. HELLWARTH

TRANSMISSION MECHANISM

Filed Sept. 25, 1922 4 Sheets-Sheet 4



Witness
H. Woodard

Inventor
R. O. HELLWARTH
By A. R. Williamson & Co
Attorney

Patented Oct. 9, 1923. **1,470,078**

UNITED STATES PATENT OFFICE.

RUSSELL O. HELLWARTH, OF CELINA, OHIO.

TRANSMISSION MECHANISM.

Application filed September 25, 1922. Serial No. 590,510.

To all whom it may concern:

Be it known that I, RUSSELL O. HELLWARTH, a citizen of the United States, residing at Celina, in the county of Mercer and State of Ohio, have invented certain new and useful Improvements in Transmission Mechanisms; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in transmission mechanisms such as those designed primarily for use upon tractors, although usable also for trucks and other forms of machines.

The transmission is of the type adapted for driving right and left hand traction wheels or tread chains in reverse directions to produce abrupt steering or turning and the principal object is to provide a mechanism of this character having a differential driving mechanism which permits relative speed changes of the right and left hand traction members during ordinary steering with a suitable steering gear, but provided with means whereby the differential may be locked when abrupt turning is to be effected, whereby after setting suitable controls for the transmission units of the right and left hand traction members, one of the members may be positively driven forwardly while the other is similarly driven in the reverse direction, whereby the machine may be turned completely around or to any desired extent.

In carrying out the above ends, I provide a forward driving and a rearward driving shaft for each of the traction members and a further object is to provide a novel arrangement of parts whereby either shaft may be operatively connected with the differential mechanism and the other shaft simultaneously disconnected therefrom.

Still further objects are to provide a novel form of differential lock and to provide a conveniently located power take-off pulley which may be driven at will from the differential mechanism, without the necessity of driving the transmission mechanism.

With the foregoing in view, the invention resides in the novel subject matter hereinafter described and claimed, the description being supplemented by the accompanying drawings.

Figure 1 is a plan view of a transmission mechanism constructed in accordance with my invention, showing one manner of applying the same to a tractor.

Figures 2, 3 and 4 are vertical longitudinal sectional views as indicated by the lines 2—2, 3—3 and 4—4 of Fig. 1, respectively.

Figure 5 is an enlarged horizontal sectional view through the differential mechanism and its locking means.

Figure 6 is an enlarged horizontal section through one of the clutches which are used for connecting the forward and rearward driving shafts operatively with the differential mechanism.

In the drawings above briefly described, the numeral 1 designates a tractor frame shown more or less diagrammatically, said frame being provided with right and left hand traction members which are here shown in the form of wheels 2, although endless tread chains might well be employed instead. I provide independent driving units for the two traction members each including a forward driving shaft 3 and a rearward driving shaft 4, the two shafts being disposed in parallel relation and having bull pinions 5 on their outer ends connecting with the teeth on the inner and outer peripheries of a bull ring 6, one of these rings being secured to each traction member 2. Spur gears 7 are loosely mounted upon the inner ends of the shafts 3 and 4 and suitable clutches, such as the disc clutch 8 detailed in Fig. 6, are employed for locking said gears to their respective shafts. Each of these clutches includes a shell 9 keyed upon the shaft, a ball bearing thrust collar 10 around the hub of the shell, and studs 11 extending from this collar through the shell to move the clutch discs which are contained within said shell, into operative engagement with each other. Forked wedges 12 cooperating with ridged forked thrust members 13 carried by the frame 1, are employed to force the collar 10 inwardly to operative position, and the wedges 12 of each driving unit are preferably carried by opposite ends of a common operating rod 14, the arrangement being such that when this rod is shifted, for instance by the hand lever 15, or any other suitable means of control, to throw the clutch 8 of the shaft 3 into play, the clutch of the shaft 4 will be simultaneously thrown out. Thus, it will be seen that the bull pinions 5 may be controlled to drive the traction members 2 in

either direction and as separate controls are provided for the two traction units, one traction member may be driven forwardly and the other reversely, to produce abrupt turning.

The gears 7 of the two driving units mesh with opposite sides of driving pinions 16 carried by the ends of shaft sections 17 which are connected by a differential mechanism detailed more particularly in Fig. 5. In this view, the numeral 18 designates a central floating driving ring carrying the usual radially disposed bevelled pinions 19 which mesh with the teeth of a pair of bevelled gears 20 which are keyed upon the shaft sections 17. The action of this arrangement is well known to produce relative speed changes of the two sections 17, for instance when one must travel faster than the other for ordinary steering, by means of a suitable steering gear (not shown). When the traction members 2 are employed for steering however it is necessary that the differential be locked so that the two shaft sections 17 will rotate as a single shaft. To obtain this result, I prefer to confine a pair of disc clutches 21 between the gears 20 and web of the floating gear 18. To operate these clutches, I provide clutch collars 22 at the ends of the differential mechanism, said collars being preferably of the ball bearing type and having studs 23 which extend through the gears 20 to move the clutch discs into operative relation with each other. For simultaneously operating both collars 22 to throw the clutches 21 into play, I provide two forked wedges 24 straddling the hubs of the gears 20 and contacting with the outer sides of said collars, said wedges 24 being cooperable with fixed thrust forks 25. The two wedges 24 are preferably carried by the ends of a U-shaped yoke 26 suitably connected with a hand lever or the like 27 and it will be understood that the arms of the yoke are jointed to permit the wedges 24 to move inwardly to some extent when forcing the collars 22 to operative position.

Any preferred means could of course be connected with the driving gear 18 for operating the differential mechanism, but this gear is preferably of the spur type meshing with a similar gear 28 on a transverse jack shaft 29 having a power take off pulley 30. By suitable means not shown, the gear 28 may be moved out of mesh with the gear 18 when only the pulley is to be used, without moving the machine forwardly or rearwardly. For rotating the shaft 29, I have shown suitable engine driven shaft 31 and variable speed gearing 32.

By providing the construction shown and described or substantially this construction, a very advantageous machine is provided. It will be seen that when the machine is being driven for instance along the roadway and the usual steering gear (not shown) is employed, the differential mechanism will remain free so as to allow any necessary variations in the speed of the two traction members 2, thereby producing easy steering. If an abrupt turn is to be made, however, the traction members 2 may be driven in opposite directions, by operating the levers 15 to set the clutches 8 so that the forward driving shaft 3 of one traction member operates and the rearward driving shaft 4 of the other traction members comes into play. Thus, the machine may be turned directly around or to any desired extent, it being understood however that before this turning operation will be carried out, it is necessary to lock the differential mechanism by shifting the lever 27 to throw the clutches 21 into play. In some instances, it may be desirable to drive one traction member either forwardly or rearwardly while having the other member free of all driving connections. When this is desired, the clutches 8 of one of the driving units may be set in a neutral position while one of the clutches of the other unit is thrown into play.

As excellent results may be obtained from the general arrangement shown and described, it is preferably followed, but within the scope of the invention as claimed, numerous minor changes may of course be made.

I claim:

1. A transmission mechanism comprising two transmission units adapted to be connected respectively to right and left traction members, each of said units including a forward driving shaft and a rearward driving shaft, an endless traction member carried element having a portion extending between said shafts and having operative connection therewith and means whereby either shaft may be thrown into play for imparting movement to the traction member, a differential, and mechanism associated with the differential for driving said transmission units at the same speed, regardless of the direction of drive.

2. A transmission mechanism comprising two transmission units adapted to be connected respectively to right and left traction members, each of said units including a forward driving shaft, a rearward driving shaft, an endless traction member carried element having a portion passing between said drive shafts and having operative connection therewith, gears loose upon said shafts respectively, and means for clutching either gear to its respective shaft while permitting the other gear to run free; a pair of shaft sections having gears meshing with said loose gears, a driven mechanism connecting said shaft sections and permitting

relative speed changing thereof when steering, and means for locking said shaft sections together for rotation in unison at the same speed when desired.

3. A structure as specified in claim 2; said means for clutching either gear to its respective shaft comprising a wedge operated clutch for each gear, and a single movable member carrying the wedges for both clutches.

4. A transmission mechanism comprising a pair of internally and externally toothed bull rings adapted to be secured to right and left hand traction members respectively, inner and outer bull pinions meshing respectively with the inner and outer teeth of said bull rings, and means for driving both outer or both inner bull pinions simultaneously in the same direction, or for simultaneously driving one outer and one inner bull pinion in opposite directions.

5. The structure of claim 4 having the bull pinions mounted upon shafts, and means for imparting rotary movement to the shafts including clutch elements and means for causing movement of the clutch elements into and out of position causing rotation of the bull pinion carrying shafts.

In testimony whereof I have hereunto affixed my signature.

RUSSELL O. HELLWARTH.

STEERING STRUCTURE FOR FARM IMPLEMENTS AND THE LIKE

Filed June 18, 1956 4 Sheets-Sheet 1

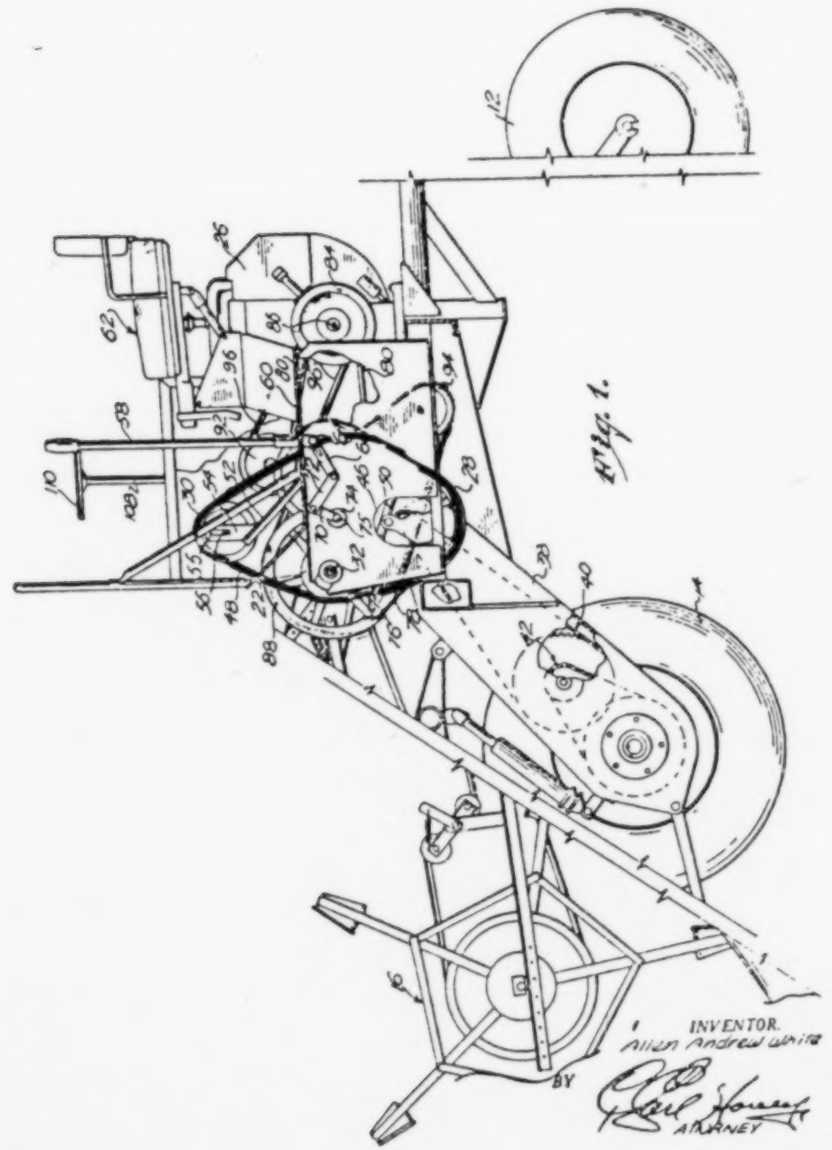


Fig. 1.

INVENTOR.
Allen Andrew White
BY
Earl Hoover
ATTORNEY

May 17, 1960 A. A. WHITE 2,936,840

STEERING STRUCTURE FOR FARM IMPLEMENTS AND THE LIKE

Filed June 18, 1956 4 Sheets-Sheet 2

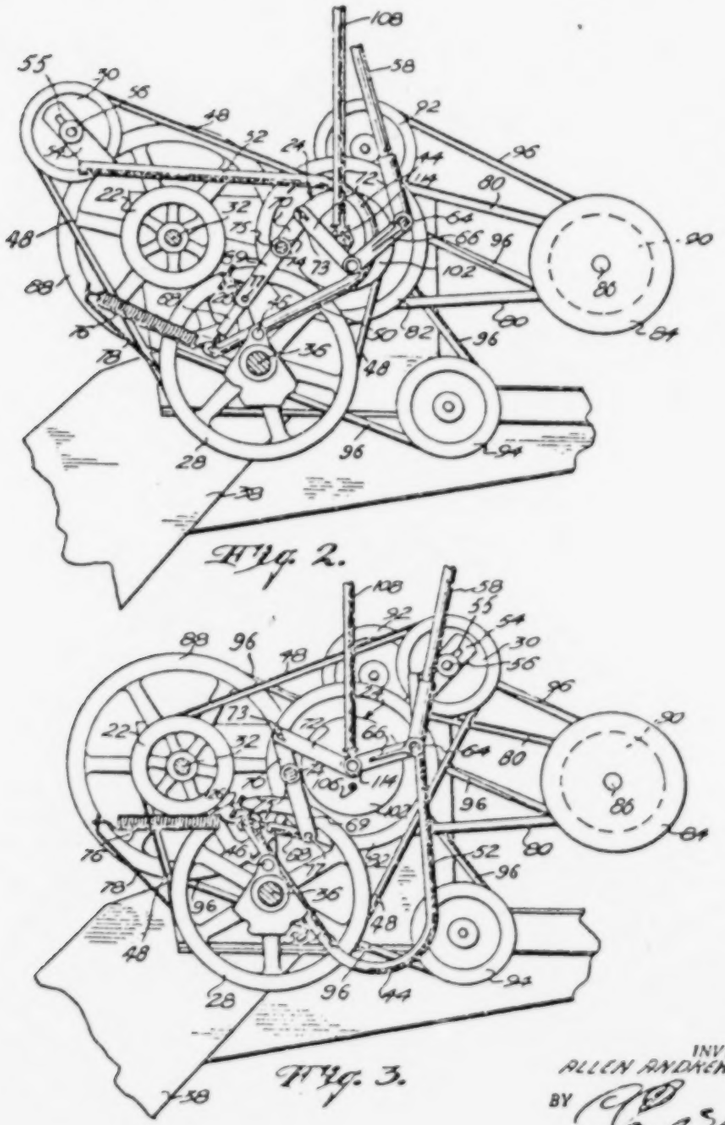


Fig. 2.

Fig. 3.

INVENTOR
ALLEN ANDREW WHITE
BY Earl Howard
ATTORNEY

May 17, 1960 A. A. WHITE 2,936,840

STEERING STRUCTURE FOR FARM IMPLEMENTS AND THE LIKE

Filed June 18, 1956 4 Sheets-Sheet 3

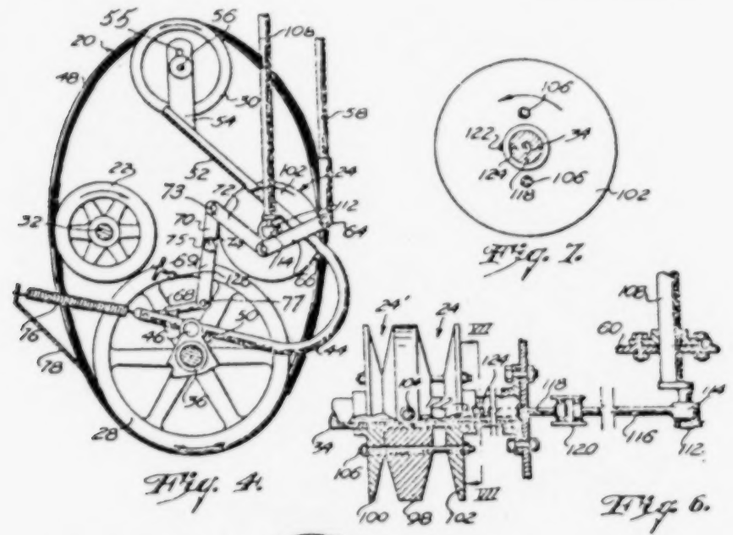


Fig. 4.

Fig. 7.

Fig. 6.

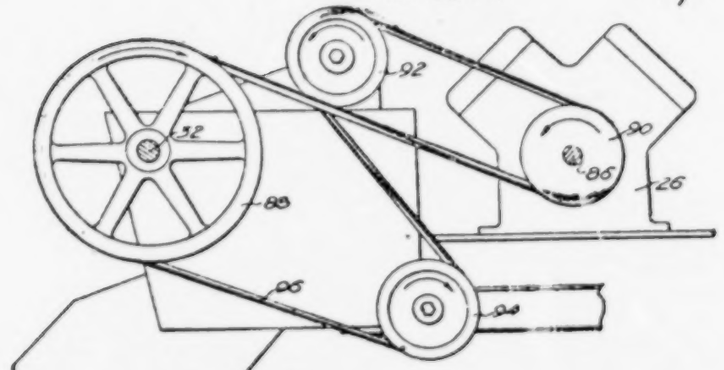


Fig. 5.

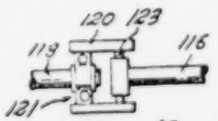


Fig. 12.

INVENTOR
ALLEN ANDREW WHITE
BY Earl Howard
ATTORNEY

May 17, 1960 A. A. WHITE 2,936,840

STEERING STRUCTURE FOR FARM IMPLEMENTS AND THE LIKE

Filed June 18, 1956 4 Sheets-Sheet 4

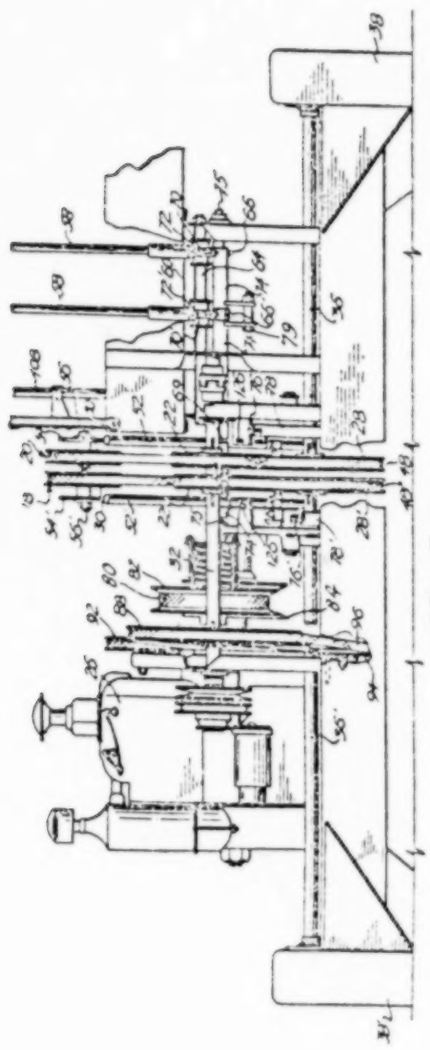


Fig. 8.

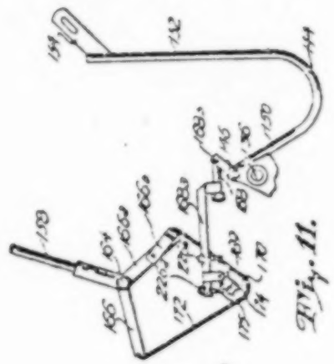


Fig. 11.

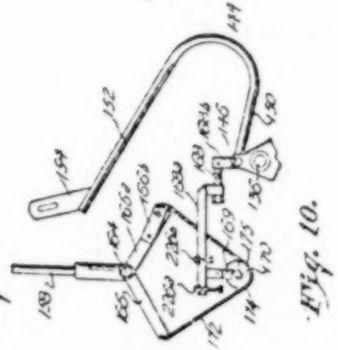


Fig. 10.

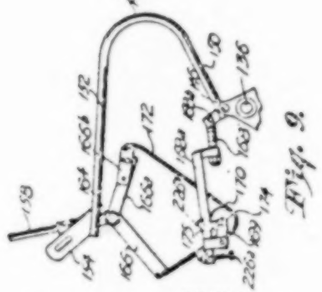


Fig. 9.

INVENTOR
ALLEN ANDREW WHITE
BY
ATTORNEY

United States Patent Office 2,936,840 Patented May 17, 1960

2,936,840

STEERING STRUCTURE FOR FARM IMPLEMENTS AND THE LIKE

Allen Andrew White, Peabody, Kans., assignor to Hesston Manufacturing Co., Inc., Hesston, Kans., a corporation of Kansas

Application June 18, 1956, Serial No. 592,083

13 Claims. (Cl. 180—6.66)

This invention relates to power transmission mechanism having many useful purposes, but adapted particularly for steering a mobile vehicle as power is transmitted to ground-engaging wheels for the primary purpose of advancing the vehicle or causing the same to move in reverse, the most important object being to permit driving of either of a pair of ground wheels, or both, at the will of the operator so that relatively sharp turns may be executed with ease and facility and so that the vehicle may be guided and maneuvered along any desired path of travel.

It is a primary object of the instant invention to provide power transmission in the nature of steering structure that is especially adapted for use in connection with farm implements and including as a part thereof duplicate belt and pulley units under direct control of the operator through manually manipulable levers to the end that as the levers are swung through predetermined paths of travel, the implement is caused to move forwardly or in reverse and along straight or curved paths of travel as may be desired or become necessary when the implement is placed in use.

Another important object of the present invention is the provision of power transmission mechanism having a driven member that is rotated in either of two directions, depending upon the position of a continuous belt with respect to a pair of oppositely rotating driving elements, the said belt being moved to opposite ends of its path of travel through the medium of a swingable idler operably connected with a manually manipulable lever as aforementioned.

Still another important object of the present invention is the provision of power transmission mechanism having spaced driving elements as aforementioned operable to alternately rotate the said driven member as the continuous flexible device, such as a belt, is swung into engagement with the selected drive element and held in a taut condition thereagainst.

A further object of the instant invention is the provision in a power transmission of the aforementioned character of novel support means for the swingable idler pulley which support is in turn capable of yieldably maintaining the continuous belt in a taut condition when the same operably engages one of the drive elements by virtue of the fact that such support is U-shaped and of resilient material.

A still further object of the instant invention is to incorporate with said resilient support for the idler pulley and with the manually manipulable lever, toggle linkage or the like capable of releasably holding the idler pulley in at least one of its operative positions against a stop, for example, until the operator is desirous of manipulating the lever to vary the speed of the corresponding ground wheel, or place the same in neutral or reverse.

It is an aim of the invention illustrated in the drawings and about to be described to provide additionally in connection with the power transmission mechanism and steering structure above outlined, a fine adjustment or auxiliary steering mechanism capable of permitting maneuvering of the vehicle at least while the same moves in one direction without necessity of operating either of the two primary steering levers.

Another aim of the present invenuon is the provision of a variable speed pulley constituting one of the drive members of one of the primary power transmission mechanisms together with manually operable means connected with the variable speed pulley for permitting limited steering of the vehicle while the two primary control levers are set in one position with their corresponding idler pulley at one end of its path of travel.

Other aims and objects relate to important details of construction and advantageous features, all of which will be made clear or become apparent as the following specification progresses, reference being had to the accompanying drawings wherein:

Figure 1 is a fragmentary side-elevational view of one type of farm implement with which the instant invention is adapted to be used, parts being broken away to reveal details of construction of the novel steering structure in the nature of power transmission mechanism;

Fig. 2 is an enlarged fragmentary view similar to Fig. 1 and partially in section illustratng the position of parts when both steering levers are at the forwardmost ends of their paths of travel;

Fig. 3 is a view similar to Fig. 2 showing the relative position of parts when the two steering levers are at the rearmost ends of their paths of travel;

Fig. 4 is a fragmentary, vertical, cross-sectional view showing one of the power transmission mechanisms in a neutral position as in Fig. 1;

Fig. 5 is a substantially vertical cross-sectional view showing in elevation the operable connection between the prime mover and one of the driven elements of the two primary power transmission mechanisms;

Fig. 6 is a fragmentary elevational view of the fine-line steering structure illustrating the other drive members of the mechanisms, one of which is in the nature of a variable speed pulley, parts being broken away and in section for clearness;

Fig. 7 is a fragmentary detailed cross-sectional view taken on line VII—VII of Fig. 6;

Fig. 8 is a fragmentary front-elevational view of the steering structure of the implement shown in Fig. 1;

Fig. 9 is an elevational view similar in parts to Fig. 4, showing a modified form of connection between one of the steering levers and its corresponding idler pulley support with the said lever at one end of its path of travel;

Fig. 10 is a view similar to Fig. 9 showing the manual control lever in neutral;

Fig. 11 is a view similar to Figs. 9 and 10 illustrating the control lever at the opposite end of its path of travel; and

Fig. 12 is an enlarged view of the joint shown in Fig. 6.

The implement chosen for illustration of the principles of the instant invention and included in part by Figs. 1 and 8 of the drawings, is in the nature of a swather supported in its entirety by a rear caster wheel 12 and a pair of opposed ground-engaging drive wheels, one only of which is illustrated in Fig. 1 and designated by the numeral 14. The implement includes as a part thereof a sickle bar and platform (not shown) above which is rotatably disposed a conventional reel 16, but inasmuch as the improvements about to be described may be employed in connection with virtually any mobile vehicle, or wherever power transmission is needed, no further details of construction or operation of the implement shown in Figs. 1 and 8 need be set forth.

The steering structure for driving the wheels 14 either

forwardly or in reverse includes a pair of primary power transmission mechanisms broadly designated by the numerals 18 and 20, and inasmuch as they are substantially identical, the unit 20 only as illustrated in Figs. 1–4, inclusive, will be described. Where duplicate parts on opposite sides are provided, such parts will bear similar numbers with one set of numbers being primed. For ease in description, only one set of numbers will be specifically referred to.

Referring especially to Fig. 4 of the drawings, the power transmission mechanism 20 includes a pair of horizontally spaced drive elements 22 and 24 that constantly rotate in opposite directions when driven by prime mover 26. A driven member 28 is disposed beneath the elements 22 and 24, preferably within a vertical plane midway between the elements 22 and 24 and an idler member 30 is spaced directly above the member 28 and above the elements 22 and 24 when the member 30 is in the neutral position shown in Fig. 4 of the drawings.

Elements 22 and 24 are secured directly to shafts 32 and 34, respectively, for rotation therewith, it being understood that the drive elements 22' and 24' of mechanism 18 are likewise secured to shafts 32 and 34 respectively, for rotation therewith.

Driven member 28 is, on the other hand, attached directly to a shaft 36 operably connected with corresponding wheel 14 through the medium of structure contained within housing 38 (see Fig. 1). Such structure may consist of a pair of operably connected chain and sprocket wheel assemblies broadly designated by the numerals 40 and 42.

Looking again to Fig. 4 of the drawings, the idler member 30 is mounted on a U-shaped support 44 that is in turn swingably carried by the frame of the implement adjacent the shaft 36 by a pivot pin 46. A continuous flexible device 48 such as a belt is trained over the elements 22 and 24 and the members 28 and 30.

The drive elements 22 and 24, the driven member 28 and the idler member 30 are all preferably in the nature of pulleys disposed within a common vertical plane as seen in Fig. 8 of the drawings. Consequently, it is seen that the axes of rotation of shafts 32, 34 and 36, as well as the axis of rotation of idler pulley 30 and the axis of swinging movement of support 44 about pivot pin 46 are horizontal and in parallelism.

The support 44 for idler pulley 30 is preferably in the nature of a resilient U-shaped loop having a lower leg 50 and an upper leg 52. The lower leg 50 is carried by the pivot pin 46 whereas upper leg 52 receives the idler pulley 30 through the medium of a laterally extending bracket 54 that is slotted at 55 to adjustably receive stub shaft 56 of the idler pulley 30. The tension of the belt 48 in either of the two positions of the idler pulley 30 shown in Figs. 2 and 3 may, therefore, be varied by shifting the idler pulley 30 with respect to the bracket 54 toward and away from the pivot pin 46.

The idler pulley 30 is swung through its path of travel about the horizontal axis of pivot pin 46 through the medium of a manually manipulable lever 58 that extends upwardly through platform 60 of the implement forwardly of the operator's seat 62. The lowermost end of the levers 58 and 58' are rotatably or hingedly mounted on a single, stationary horizontal shaft 64 disposed beneath the platform 60 and extending toward the mechanism 20. A lateral extension 66 is rigid to the lowermost end of the lever 58 for swinging movement therewith as a unit.

Toggle linkage operably interconnecting the extension 66 and the lower leg 50 of loop 44 includes element 68 and links 69, 70 and 72, the link 70 being adjacent lever 58 beneath platform 60 and rigidly secured to a rotatable tube 74. Link 72, disposed below platform 60, has one end pivotally connected to the uppermost end of the link 70 as at 73 and its other end with the outermost end of the extension 66, whereas the element 68 has one end

pivotally connected to the forwardmost end of the leg 50 and its other end to the lowermost end of the link 69 as at 77, link 69 being transversely spaced from link 70 and link 69 also being rigid to tube 74. It is to be noted that for purposes of adjustment, the element 68 is extensible. A spring 76 connects the forwardmost free end of the leg 50 with a bracket 78 that is in turn carried by the framework of the implement. Tube 74 comprises two portions each of which, as shown in Fig. 8, is telescoped on a rotatable shaft 75, one on each side of the lever 58. Shaft 75, to which lever 58' is rigidly secured, has transversely-spaced links 69' and 70' affixed thereto so that movement of lever 58' rotates shaft 75 and the affixed links 69' and 70'. As shown in Fig. 8, the two portions of tube 74 are rigidly connected together by a coupling 79 which bridges link 70' and lever 58' so that swinging movement of lever 58 is transmitted to support 44 by means of the rigidly interconnected portions of tube 74. Link 70 is rigid to tube 74 on one side of coupling 79 and link 69 is rigid to tube 74 on the opposite side of coupling 79.

During operation of the primer mover 26, the drive pulley 24 is driven in the direction of the arrow shown in Fig. 4 through the medium of a continuous belt 80 (Figs. 2, 3 and 8) trained over pulleys 82 and 84, secured to shaft 34 and power shaft 86, respectively, the latter of which is the drive shaft of prime mover 26 as seen in Fig. 5. The drive pulley 22 is, however, driven in the opposite direction as shown by the arrow in Fig. 4 from the prime mover 26 through the medium of the arrangement shown in Fig. 5 of the drawing. To this end, pulleys 88 and 90 are affixed to shafts 32 and 86, respectively, and the frame of the implement carries a pair of idler pulleys 92 and 94. A continuous belt 96 is trained over the pulleys 88, 90, 92 and 94, it being seen in Fig. 8 that the pulleys 92 and 94 are offset in opposite directions with respect to two aligned pulleys 88 and 90 for preventing undue wear in the belt 96 which would otherwise occur by stretches thereof rubbing together at the point of crossing adjacent the pulley 92.

Secondary steering control structure operable in conjunction with the primary power transmission mechanisms 18 and 20 is best seen in Figs. 6 and 7 of the drawings. In this connection, the drive pulleys 24 and 24' are in the nature of a composite unit, including a center section 98 and a pair of outermost sections 100 and 102. The center section 98 is secured to the shaft 34 for rotation therewith through the medium of a set screw or the like 104, and the sections 100—102 are interconnected by a plurality of bolts 106 slidable in section 98.

The sections 100 and 102 are reciprocable or slidable on the shaft 34 toward and away from the center section 98, preventing the pulleys 24 and 24' of varying diameters, to drive the belts 48—48' and, therefore, the pulleys 28—28' at varying speeds when the belts 48—48' are in operative engagement with the pulleys 24—24' as shown in Fig. 2 of the drawings. The pressure of belts 48—48' on pulleys 24—24' keeps sections 100—102 in proper relationship.

A steering post 108 extending upwardly through the platform 60 to one side of the steering levers 58 and 58' carries a steering wheel 110 on the uppermost end thereof and an eccentrically disposed stub shaft 112 on its lowermost end. A collar or bearing 114 on one end of a shaft 116 is rotatable on the stub shaft 112 and couples with a shaft 118 by a joint 120 having a bearing 121 for shaft 118. A pin 123 pivotally attaches shaft 116 to joint 120. The shaft 118 is rotatable within joint 120 and extends into the proximal end of the shaft 34 for reciprocation along the longitudinal, horizontal axis of rotation of shaft 34. Shaft 118 connects with the outer section 102 of pulley 24 through the medium of a set screw or the like 122. It is to be noted that the shaft 34 is provided with a short clearance slot 124 for the fastening means 122. The joint 120 not only permits

rotation of the shaft 118 with the shaft 34, and with respect to the shaft 116, but permits swinging of the latter with respect to the shaft 118 during rotation of the steering post 108 and, therefore, its depending stub shaft 112.

For clearness of illustration, both of the levers 58 and 58' are shown vertical in the neutral position in Fig. 4, both are shown swung forwardly in Fig. 2 and both are illustrated in Fig. 3 of the drawings retracted to the rearmost ends of their paths of travel toward the operator's seat 62. Fig. 1 of the drawing similarly shows the neutral position of both of the steering levers 58 and 58'.

In operation, it is clear that when the levers 58 and 58' are vertically disposed as shown in Figs. 1 and 4, belts 48 and 48' will be wrapped rather loosely around their corresponding pulleys 22—22', 24—24', 28—28', and 30—30'. Consequently, even during continuous operation of prime mover 26, driving both of the pulleys 22 and 22' clockwise, viewing Fig. 4, and rotating both pulleys 24 and 24' anticlockwise, viewing Fig. 4, no rotative movement will be imparted to the pulleys 28 and 28', and therefore, shafts 36 and 36' as well as corresponding wheels 14 remain motionless.

Manifestly, the speed of operation of the prime mover 26, preferably in the nature of a gasoline engine, may be varied through conventional throttle control means (not shown), but when the two power transmission mechanisms 18 and 20 are neutral, pulleys 22—22' are driven idly from power shaft 86 through pulley 90 and belt 96 which in turn drives pulley 88 and therefore the shaft 32 to which the two drive pulleys 22 and 22' are affixed. By the same token, the two pulleys 24—24' i.e., the composite unit shown in Fig. 6 of the drawings, will rotate idly with the shaft 34 as the latter is driven directly from the shaft 86 through pulleys 82 and 84 and belt 80.

When it is desired to move forwardly in a straight line, the steering wheel 110 is first rotated to in turn rotate the post 108, swing the stub shaft 112, and shift the shafts 116 and 118 to the left, viewing Fig. 6. As the shaft 118 slides inwardly with respect to the shaft 34 and as the fastener 122 slides along the slot 124, the pulley section 102 is moved toward the center section 98 as it slides on the shaft 34. With the diameters of the pulleys 24 and 24' thus equalized, belts 48 and 48', respectively, will be driven at the same rates of speed when such belts are brought into engagement with their corresponding pulleys 24 and 24'.

This is accomplished by swinging both of the levers 58 and 58' forwardly to the forwardmost ends of their paths of travel as illustrated in Fig. 2 of the drawings. It is seen by viewing Figs. 2 and 4 that such swinging movement of lever 58 about the shaft 64 anticlockwise swings the extension 66 downwardly and rearwardly. Extension 66 exerts a pull upon the link 72 which in turn, by virtue of its pivotal connection with the link 70, rotates the tube 74 clockwise. As the lowermost end of the link 69 swings upwardly and forwardly, the distance between tube 74 and the outermost, forwardmost end of the leg 50 is increased. The supporting loop 44 for the idler pulley 30 is thereby swung anticlockwise about the axis of pivot pin 46 and against the action of spring 76.

The links 68 and 69 are permitted to swing slightly beyond center, i.e., beyond a straight line connecting tube 74 and the outermost free end of the leg 50 before striking an adjustable stop 126. The idler pulley 30 is therefore releasably held in the position shown in Fig. 2 of the drawings permitting the operator to release his grip on the lever 58.

It is seen in Fig. 2 of the drawings that when the pulley 30 is disposed at the forwardmost end of its path of travel, belt 48 is brought against the pulley 24 and swung away from the pulley 22, the latter continuing to rotate clockwise, viewing Fig. 2, without any effect upon the ground wheels 14. Rotation of the shaft 34, and therefore the pulley 102, causes rotation of the drive pulley 28 and, of course, the idler pulley 30 anticlockwise

which drives the shaft 36 to rotate the wheel 14 that can be seen in Fig. 1 through the interconnection 40—42 between shaft 36 and the wheel 14. By the same token, when the lever 58' is also at the forwardmost end of its path of travel, belt 48' will be driven from pulley 24' to in turn rotate the shaft 36' and a corresponding wheel 14 forwardly in the same direction as the wheel 14 shown in Fig. 1 is driven.

At any time the operator positioned on seat 62 desires to manipulate a turn or guide the implement to the left or to the right, it is but necessary but to manipulate the levers 58 and 58'. For example, while lever 58 is in the position shown in Fig. 2, the lever 58' might be retracted toward the seat 62, thereby releasing the tension of belt 48' on pulley 24', causing the implement to veer to the right because of the greater speed of travel of the wheel 14 shown in Fig. 1. In fact, if the lever 58' is moved to a neutral position as shown in Fig. 4 while the lever 58 is at the forwardmost end of its path of travel, in the manner illustrated by Fig. 2, the wheel corresponding to shaft 36' will no longer be driven and, by virtue of continued driving of the wheel 14 shown in Fig. 1, the implement will turn about a vertical axis and continue to rotate 360° if such is desired.

It is contemplated, however, that minor turning movements in the implement may be executed independently of the levers 58 and 58', and while the same are at the forwardmost ends of their paths of travel. This is accomplished by manipulation of the steering wheel 110 since the speed of rotation of the pulley 28 is increased as soon as the pulley section 102 is shifted away from the center section 98. It is contemplated that the pulleys 24 and 24' will be of substantially the same effective diameter when the pulley sections 100—102 are equally spaced from the section 98. Consequently, manipulation of the steering wheel 110 will cause the implement to veer to the right whenever the pulley sections 100—102 are retracted to increase the diameter of pulley 24 and decrease the diameter of pulley 24', and to the left whenever the pulley sections 100—102 are moved toward the pulley 82 to increase the diameter of pulley 24' and decrease the diameter of pulley 24.

It is manifest that levers 58 and 58' must be pulled toward the seat 62 to the neutral position shown in Figs. 1 and 4 before the implement can be placed in reverse. The reverse action is accomplished by retracting the levers 58 and 58' to the rearmost ends of their paths of travel as shown in Fig. 3 which causes the idler pulleys 30 and 30' to swing their corresponding belts 48 and 48' to a position engaging pulleys 22 and 22', respectively.

A safety factor is provided, as seen in Fig. 3 for reverse operation in that support 44 strikes shaft 36 before the extension 66 and link 72 are permitted to closely approach alignment. Accordingly, as soon as the levers 58 and 58' are released by the operator, the springs 76' and 76' automatically return both power transmission mechanisms 18 and 20 to the neutral position.

The fine-line steering shown in Fig. 6 of the drawings is ineffective and not believed necessary for reverse travel and such steering in reverse may be effected by manipulation of the levers 58 and 58' toward and away from the rearmost ends of their paths of travel.

The particular nature of the supports 44 -44' is extremely important. The formation thereof in substantially U-shaped loops and the utilization of somewhat resilient material in the manufacture thereof places a yieldable bias upon the corresponding idler pulleys 30 and 30' whenever the latter are either at the forwardmost or rearward ends of their paths of travel. Viewing Fig. 2, for example, it is seen that belt 48 is kept in a taut condition tightly engaging not only the drive pulley 24, but the driven pulley 28 and as the leg 52 tends to yield toward the leg 50, the resiliency within the bight of the loop 44 will tend to bias the pulley 30 upwardly and forwardly away from the pivot point 46, thereby main-

taining the belt 48 stretched to its limit provided, of course, that the pulley 30 is properly adjusted with respect to its supporting bracket 54. The same effect of the loop 44 upon the belt 48 is apparent in Fig. 3 when the idler pulley 30 is disposed to hold the belt 48 tightly against the drive pulley 22.

In Figs. 9 to 11, inclusive, there is shown a modified form of operable connection between manual lever 158 and support or loop 144 for an idler pulley (not shown) comparable to pulleys 30—30'. It is seen that U-shaped loop 144 is provided with a lower leg 150 and an upper leg 152, together with a slotted bracket 154 rigid to the leg 152 for receiving such idler pulley. The lower leg 150 of loop 144 is swingably supported by pivot pin 146 adjacent shaft 136 in much the same manner as above described with respect to the form illustrated in Figs. 1 to 8, inclusive. Similarly, the lever 158 is rotatable on shaft 164 and is provided with a lateral extension 166 rigid thereto.

Additionally, in the form shown in Figs. 9–11, there is provided a second lateral extension 166*a* rigid to lever 158 for rotation therewith and extending oppositely to the extension 166. The two extensions 166 and 166*a* are joined by a chain 172 that passes beneath a rotatable sprocket wheel 170 rigid to a tube 174 rotatable on shaft 175. The tube 174 has a short lateral extension 169 rigidly secured thereto which is in turn pivotally connected to an elongated arm 168*a* adjacent one end of the latter. The opposite end of the arm 168*a* is in turn adjustably and pivotally connected to an extension 168*b* rigid to the lowermost and forwardmost end of the leg 150 through the medium of a bolt or the like, 168. The tightness of the chain 172 may be varied through the medium of a plate 166*b* swingable on the extension 166*a* and to which one end of the chain 172 is attached. The limits of swinging movement of the lever 158 are determined by adjustable stops 226*a* and 226*b*, depending from the arm 168*a* and alternately engageable with the tube 174 as seen in Figs. 9 and 11. In all respects, however, the two power transmission mechanisms 18 and 20 operate essentially the same whether the toggle linkage shown, for example, in Fig. 4 is employed, or the connecting structure of Figs. 9 to 11, inclusive, is utilized.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In power transmission mechanism, a pair of horizontally spaced drive pulleys; a prime mover having a power shaft; means interconnecting the power shaft and one of the drive pulleys for rotating the latter in one direction; means interconnecting the power shaft and the other drive pulley for rotating the latter in the opposite direction; a driven pulley beneath the drive pulleys; a U-shaped, resilient loop having an upper and a lower leg, pivot means adjacent the driven pulley mounting the lower leg for swinging movement of the loop; an idler pulley normally disposed above the drive and driven pulleys within a vertical plane common thereto, said idler pulley being mounted on the upper leg for rotation on a horizontal axis parallel with the axes of rotation of the drive and driven pulleys and with the axis of swinging movement of said loop; a continuous belt trained over the pulleys; and manually manipulable structure connected with said loop for swinging the same to force the belt against either of said drive pulleys whereby to rotate the driven pulley in either direction.

2. In a power transmission, a frame; a pair of longitudinally spaced drive shafts rotatably carried by the frame; a drive pulley secured to each shaft respectively; a driven pulley rotatably carried by the frame; an idler pulley spaced from the driven pulley and coplanar with the latter and with the drive pulleys; a continuous, normally stationary belt trained around the pulleys; a substantially U-shaped support for the idler pulley normally looped around one of said shafts and having a pair of legs and a bight; pivot means mounting one of said legs on the frame for swinging movement of the support about an axis substantially parallel with the axes of the pulleys; means rotatably mounting the idler pulley on the other of said legs; and control means carried by the frame and coupled with said support for swinging the latter to tighten the belt against either of said drive pulleys, said pivot means being disposed to position said bight in close looped relationship to said one shaft when the belt engages the drive pulley of the latter and remote from said one shaft when the belt engages the other of said drive pulleys.

3. In a power transmission, a frame; a pair of longitudinally spaced, horizontal drive shafts rotatably carried by the frame, a drive pulley secured to each shaft respectively; a driven pulley rotatably carried by the frame below the drive pulleys; an idler pulley spaced from the driven pulley and coplanar with the latter and with the drive pulleys above the latter; a continuous, normally stationary belt trained around the pulleys; a substantially U-shaped support for the idler pulley normally looped around one of said shafts and having a pair of legs and a bight; pivot means mounting one of said legs on the frame for swinging movement of the support about an axis substantially parallel with the axes of the pulleys; means rotatably mounting the idler pulley on the other of said legs; and control means carried by the frame and coupled with said support for swinging the latter to tighten the belt against either of said drive pulleys, said pivot means being disposed to position said bight in close looped relationship to said one shaft when the belt engages the drive pulley of the latter and remote from said one shaft when the belt engages the other of said drive pulleys, and being disposed to position said other leg substantially horizontally, overlying the shafts when the belt engages said drive pulley of said one shaft, and substantially vertically when the belt engages said other drive pulley.

4. In a power transmission, a frame; a prime mover on the frame; a pair of longitudinally spaced drive shafts rotatably carried by the frame; a drive pulley secured to each shaft respectively; a driven pulley rotatably carried by the frame below the drive pulleys; an idler pulley spaced from the driven pulley and coplanar with the latter and with the drive pulleys; a continuous, normally stationary belt trained around the pulleys; a substantially U-shaped support for the idler pulley normally looped around one of said shafts and having a pair of legs and a bight; pivot means mounting one of said legs on the frame for swinging movement of the support about an axis substantially parallel with the axes of the pulleys; means rotatably mounting the idler pulley on the other of said legs; control means carried by the frame and coupled with said support for swinging the latter to tighten the belt against either of said drive pulleys, said pivot means being disposed to position said bight in close looped relationship to said one shaft when the belt engages the drive pulley of the latter and remote from said one shaft when the belt engages the other of said drive pulleys, and being disposed to position said other leg substantially horizontally, overlying the shafts when the belt engages said drive pulley of said one shaft, and substantially vertically when the belt engages said other drive pulley; means coupling the prime mover with said one shaft for driving the latter continuously in one direction; and means coupling the prime mover with the other shaft for driving the latter continuously in the opposite direction.

5. In a power transmission, a frame; a pair of longitudinally spaced drive shafts rotatably carried by the frame; a drive pulley secured to each shaft respectively; a driven pulley rotatably carried by the frame; an idler pulley spaced from the driven pulley and coplanar with the latter and with the drive pulleys; a continuous, normally stationary belt trained around the pulleys; a substantially U-shaped support for the idler pulley normally looped around one of said shafts and having a pair of legs and a bight; pivot means mounting one of said legs on the frame for swinging movement of the support about an axis substantially parallel with the axes of the pulleys; means rotatably mounting the idler pulley on the other of said legs; a manual control lever; means mounting said lever on the frame for swinging movement in a plane substantially parallel with the plane of said pulleys and the plane of swinging movement of said support; and means coupling the lever with said support to swing the latter in response to swinging of the lever to thereby tighten the belt against either of said drive pulleys, said pivot means being disposed to position said bight in close looped relationship to said one shaft when the belt engages the drive pulley of the latter and remote from said one shaft when the belt engages the other of said drive pulleys, and being disposed to position said other leg substantially horizontally, overlying the shafts when the belt engages said drive pulley of said one shaft, and substantially vertically when the belt engages said other drive pulley.

6. In a power transmission, a frame; a prime mover on the frame; a pair of longitudinally spaced drive shafts rotatably carried by the frame; a drive pulley secured to each shaft respectively; a driven pulley rotatably carried by the frame; an idler pulley spaced from the driven pulley and coplanar with the latter and with the drive pulleys; a continuous, normally stationary belt trained around the pulleys; a support for the idler pulley; pivot means mounting the support on the frame for swinging movement about an axis substantially parallel with the axis of the pulleys; means rotatably mounting the idler pulley on the support; control means carried by the frame and coupled with said support for swinging the latter to tighten the belt against either of said drive pulleys; means coupling the prime mover with one of said shafts for driving the latter continuously in one direction; and means coupling the prime mover with the other shaft for driving the latter continuously in the opposite direction.

7. In a power transmission, a frame; a prime mover on the frame; a pair of longitudinally spaced, horizontal drive shafts rotatably carried by the frame; a drive pulley secured to each shaft respectively; a driven pulley rotatably carried by the frame below the drive pulleys; an idler pulley spaced from the driven pulley and coplanar with the latter and with the drive pulleys above the latter; a continuous, normally stationary belt trained around the pulleys; a substantially U-shaped support for the idler pulley normally looped around one of said shafts and having a pair of legs and a bight; pivot means mounting one of said legs on the frame for swinging movement of the support about an axis substantially parallel with the axes of the pulleys; means rotatably mounting the idler pulley on the other of said legs; control means carried by the frame and coupled with said support for swinging the latter to tighten the belt against either of said drive pulleys, said pivot means being disposed to position said bight in close looped relationship to said one shaft when the belt engages the drive pulley of the latter and remote from said one shaft when the belt engages the other of said drive pulleys, and being disposed to position said other leg substantially horizontally, overlying the shafts when the belt engages said drive pulley of said one shaft, and substantially vertically when the belt engages said other drive pulley; means coupling the prime mover with said one shaft for driving the latter continuously in one direction; and means coupling the prime mover with the other shaft for driving the latter continuously in the opposite direction.

8. In a power transmission, a frame; a pair of longitudinally spaced, horizontal drive shafts rotatably carried by the frame; a drive pulley secured to each shaft respectively; a driven pulley rotatably carried by the frame below the drive pulleys; an idler pulley spaced from the driven pulley and coplanar with the latter and with the drive pulleys above the latter; a continuous, normally stationary belt trained around the pulleys; a substantially U-shaped support for the idler pulley normally looped around one of said shafts and having a pair of legs and a bight; pivot means mounting one of said legs on the frame for swinging movement of the support about an axis substantially parallel with the axes of the pulleys; means rotatably mounting the idler pulley on the other of said legs; a manual control lever; means mounting said lever on the frame for swinging movement in a plane substantially parallel with the plane of said pulleys and the plane of swinging movement of said support; means coupling the lever with said support to swing the latter in response to swinging of the lever to thereby tighten the belt against either of said drive pulleys, said pivot means being disposed to position said bight in close looped relationship to said one shaft when the belt engages the drive pulley of the latter and remote from said one shaft when the belt engages the other of said drive pulleys, and being disposed to position said other leg substantially horizontally, overlying the shafts when the belt engages said drive pulley of said one shaft, and substantially vertically when the belt engages said other drive pulley.

9. In a power transmission, a frame; a prime mover on the frame, a pair of longitudinally spaced drive shafts rotatably carried by the frame; a drive pulley secured to each shaft respectively; a driven pulley rotatably carried by the frame; an idler pulley spaced from the driven pulley and coplanar with the latter and with the drive pulleys; a continuous, normally stationary belt trained around the pulleys; a substantially U-shaped support for the idler pulley normally looped around one of said shafts and having a pair of legs and a bight; pivot means mounting one of said legs on the frame for swinging movement of the support about an axis substantially parallel with the axes of the pulleys; means rotatably mounting the idler pulley on the other of said legs; a manual control lever; means mounting said lever on the frame for swinging movement in a plane substantially parallel with the plane of said pulleys and the plane of swinging movement of said support; means coupling the lever with said support to swing the latter in response to swinging of the lever to thereby tighten the belt against either of said drive pulleys, said pivot means being disposed to position said bight in close looped relationship to said one shaft when the belt engages the drive pulley of the latter and remote from said one shaft when the belt engages the other of said drive pulleys, and being disposed to position said other leg substantially horizontally, overlying the shafts when the belt engages said drive pulley of said one shaft, and substantially vertically when the belt engages said other drive pulley.

10. In a power transmission, a frame; a pair of longitudinally spaced drive shafts rotatably carried by the frame; a drive pulley secured to each shaft respectively; a driven pulley rotatably carried by the frame; an idler pulley spaced from the driven pulley and coplanar with the latter and with the drive pulleys; a continuous, normally stationary belt trained around the pulleys; a support for the idler pulley; pivot means mounting the support on the frame for swinging movement about an axis substantially parallel with the axis of the pulleys; means rotatably mounting the idler pulley on the support; a manual control lever; means mounting said lever on the frame for swinging movement in a plane substantially parallel with the plane of said pulleys and the plane of swinging movement of said support; and means coupling the lever with said support to swing the latter in response to swinging of the lever to thereby tighten the belt against either of said drive pulleys, said pivot means being disposed to position said bight in close looped relationship to said one shaft when the belt engages the drive pulley of the latter and remote from said one shaft when the belt engages the other of said drive pulleys, and being disposed to position said other leg substantially horizontally, overlying the shafts when the belt engages said drive pulley of said one shaft, and substantially vertically when the belt engages said other drive pulley.

11. In a vehicle having a frame, a prime mover on the frame, a pair of ground engaging wheels supporting the frame and a pair of longitudinally spaced drive shafts rotatably carried by the frame, a power transmission on the frame for each wheel respectively, each including a drive pulley secured to each shaft respectively; a driven pulley rotatably carried by the frame; an idler pulley spaced from the driven pulley and coplanar with the latter and with the drive pulleys; a continuous, normally stationary belt trained around the pulleys; a support for the idler pulley; pivot means mounting the support on the

frame for swinging movement about an axis substantially parallel with the axis of the pulleys; means rotatably mounting the idler pulley on the support; control means carried by the frame and coupled with said support for swinging the latter to tighten the belt against either of said drive pulleys; means coupling the prime mover with one of said shafts for driving the latter continuously in one direction; means coupling the prime mover with the other shaft for driving the latter continuously in the opposite direction; and structure coupling each wheel with its corresponding driven pulley.

12. In a vehicle having a frame, a pair of ground-engaging wheels supporting the frame and a pair of longitudinally spaced drive shafts rotatably carried by the frame, a power transmission on the frame for each wheel respectively, each including a drive pulley secured to each shaft respectively; a driven pulley rotatably carried by the frame; an idler pulley spaced from the driven pulley and coplanar with the latter and with the drive pulleys; a continuous, normally stationary belt trained around the pulleys; a support for the idler pulley; pivot means mounting the support on the frame for swinging movement about an axis substantially parallel with the axis of the pulleys; means rotatably mounting the idler pulley on the support; a manual control lever; means mounting said lever on the frame for swinging movement in a plane substantially parallel with the plane of said pulleys and the plane of swinging movement of said support; means coupling the lever with said support to swing the latter in response to swinging of the lever to thereby tighten the belt against either of said drive pulleys; and structure coupling each wheel with its corresponding driven pulley.

13. In a vehicle having a frame, a pair of ground-

engaging wheels supporting the frame and a pair of longitudinally spaced drive shafts rotatably carried by the frame, a power transmission on the frame for each wheel respectively, each including a drive pulley secured to each shaft respectively; a driven pulley rotatably carried by the frame; an idler pulley spaced from the driven pulley and coplanar with the latter and with the drive pulleys; a continuous, normally stationary belt trained around the pulleys; a substantially U-shaped support for the idler pulley normally looped around one of said shafts and having a pair of legs and a bight; pivot means mounting one of said legs on the frame for swinging movement of the support about an axis substantially parallel with the axes of the pulleys; means rotatably mounting the idler pulley on the other of said legs; control means carried by the frame and coupled with said support for swinging the latter to tighten the belt against either of said drive pulleys, said pivot means being disposed to position said bight in close looped relationship to said one shaft when the belt engages the drive pulley of the latter and remote from said one shaft when the belt engages the other of said drive pulleys; and structure coupling each wheel with its corresponding driven pulley.

References Cited in the file of this patent

UNITED STATES PATENTS

2,311,393	Honeywell	Feb. 16, 1943
2,329,372	Hitch	Sept. 14, 1943
2,450,262	Winslow et al.	Sept. 28, 1948

FOREIGN PATENTS

172,528	Austria	Sept. 25, 1952

PLAINTIFF'S EXHIBIT 100